COMPUTING DEVICES AND LEARNING THEORY:

A STUDY OF HOW STUDENTS INVOLVED IN ONE-TO-ONE COMPUTING PROGRAMS UTILIZE THEIR DEVICES TO FORM LEARNING IN OUT-OF-SCHOOL ENVIRONMENTS

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Dedication

I dedicate this work to my mother, Debbie Allen, who did so much to provide me with a foundation for success, but is not able to be physically present to share in this accomplishment.

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With the integration of technology into our society and the education system comes the need to better understand how the students of today are using computing devices for the purposes of learning. This qualitative study utilizes Mocker and Spear's learning identification model for guidance and views student learning through the theoretical frameworks of behaviorism, cognitivism, and constructivism, as well as the relatively newly formed learning theory of connectivism, to answer the question, "*How do students involved in one-to-one laptop programs utilize computing devices to form learning in out-of-school environments?*" Findings from the study reveal various ways in which students utilize computer access to autonomously gather information and learn on their own; the study suggests that when students did participate in autonomous and self-directed learning with their computing devices, they reported utilizing a variety of informational resources, were more likely to be engaged in the learning process, and were more likely to share their learning with others through digital mediums. Furthermore, the study identifies ways in which participants utilize their access to computing devices and freedom to use these devices with autonomy and in a self-directed manner in order to build upon and discover personal identity.

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Chapter 1: Introduction

Many educators and theorists claim that the digital age has brought new types of learners to our schools. These learners are often referred to as "digital natives," as they only know a world in which aspects of their learning occur through the medium of digital technology (Ribble, 2008). Barone (2003) and Brown (2005) state that evidence is accumulating that demonstrates that the thinking patterns of digital natives are significantly different than their digital immigrant parents and teachers. Siemens (2005) and S. Downes (2005) suggest that due to this phenomenon, digital technology has actually rewired the brains of our digital native students and has changed the way in which they learn. Siemens and Downes go on to argue that student learning through the ubiquity of technology requires a new learning theory, as existing learning theories cannot fully explain and account for the changes that have occurred in the digital age. Thus, in 2005 Siemens and Downes introduced the theory of "connectivism" to address the components of collective learning communities and the concept that learning is a "cyclical process" in which learners "will connect to a network to share and find new information, will modify their beliefs on the basis of new learning, and will then connect to a network to share these realizations and find new information once more" (Kop & Hill, 2008). Furthermore, Siemens and Downes assert that a revolutionary component of connectivism is that learning can occur outside of the learner and within networks and organizations.

Critics of connectivism claim a that new learning theory is not needed to understand the integration of technology, as these aspects are accounted for by the existing learning theories of behaviorism, cognitivism, and constructivism—and that "new learning" is simply being wrapped in new packaging (Kerr, 2007). Others state that it is not as easy as accepting or rejecting the theory, but rather not limiting oneself to one particular theory when looking to address problems

in learning. Snelbecker (1999) urges educators to "examine each of the basic science theories which have been developed by psychologists in the study of learning and to select those principles and conceptions which seem to be of value for one's particular educational situation" (p. 8). Regardless of learning theory, claims have been made that the integration of computer technology will bring about a revolution in our education system, as to educate students in this new era will mean a fundamental shift in how we prepare our future citizenry for a world that is rapidly changing and becoming more and more "digital" (Mossberger, Tolbert, & McNeal, 2008).

Schools of today recognize that in order for the children of our society to survive and thrive in this environment as 21st century citizens, it is essential that they learn the knowledge and skills to navigate these new and rapidly advancing technologies (Becker, 2006; Hooft & Swan, 2007; Mossberger et al., 2008). However, not all students have access to digital resources, thus creating a gap in opportunity that these resources provide, otherwise known as the "digital divide" (Mossberger et al., 2008). Recognizing the role that technology plays in society, and the lack of universal access to these resources, many schools are attempting to address the divide by providing all students with individual laptop devices, otherwise known as one-to-one laptop programs (1:1), or ubiquitous computer programs (Mossberger et al., 2008).

With the broad implementation of these programs have come studies that attempt to determine what effects these 1:1 computing initiatives are having on student learning and achievement (Bebell & Kay, 2010; Dunleavy, Dextert, & Heinecket, 2007; Holcomb, 2009). The majority of studies to date have been quantitative in nature and place a major emphasis on student standardized test scores to determine student learning. Other studies have taken a qualitative approach and look beyond quantitative data analysis to assess the influence of the

programs in regard to student engagement, student behavior, and teacher implementation (Lei & Zhao, 2008); however, most research conducted in the area of ubiquitous computing initiatives has been focused on how these initiatives are impacting student learning within the traditional one-to-one school environment (Bebell & Kay, 2010; Dunleavy et al., 2007; Lei & Zhao, 2008). What happens with these devices when students take them away from the school building is an area in need of further study (Grant, 2011).

Data gathered from this study can lead to better understanding of how students form learning with computing devices and might influence practice and policy at various educational system levels. On the federal level, countries like the UK and Australia are experimenting with the provision of laptop devices and Internet connectivity grants to citizens that qualify (Jewitt & Parashar, 2011). In the US, Maine has backed the implementation of one-to-one laptop programs in all of their middle schools since 2002; and numerous districts in all 50 states have begun the implementation of one-to-one programs with many more waiting to determine their effectiveness (File, 2013). With a better understanding of how students learn with their computer devices within and outside of one-to-one schools, a more informed decision-making process can occur within the classroom, as well as the federal, state, and local levels.

Overview of Sections

This paper will begin with a statement of the problem of study and will recognize a gap in the existing research that needs to be filled. Following, the purpose of the study will be provided and detailed research goals and objectives will be identified and briefly discussed. This section of the proposal will also clarify what will not be addressed, so as to limit the scope and focus of the study. The next section titled “Rationale / Significance” will discuss the contributions of the study to existing research and the possible implications on policy and

practice in the field of education. A research question will then be provided for the study followed by definitions of key terms. The researcher will then state the limitations of the study.

Chapter 2 will examine key literature associated with the topic of the study. The review of literature will begin with a summary of the learning theories that will serve as the theoretical framework for the study: behaviorism, cognitivism, constructivism, and connectivism. A model of learning, provided by Mocker and Spear (1982), will then be presented as a guide in which to code various types of learning activities. The researcher will then contribute a section on the history and background of one-to-one laptop programs in the U.S. education system before shifting to focus on research conducted on the influence of one-to-one laptop programs on student learning. The first of these sections will concentrate on one-to-one laptop programs and student "formal" learning outcomes—specifically aimed at standardized test scores as the benchmark for data. Next, literature covering the aspects of "informal" learning away from the traditional school environment will be discussed.

The third chapter will review the methodology of the study. Here, the researcher will provide an overall methodological approach and explain how this approach will match the design of the study along with a description of data collection methods and how these data will be analyzed and interpreted.

This case study will be qualitative in methodological nature and will seek to provide a greater understanding of student learning outside of the traditional school environment through the insights of the students who are immersed in this process.

Problem Statement

Most research conducted in the area of computing initiatives has been focused on how these programs impact student learning within the boundaries of the formal curriculum that is

delivered during the traditional school day (Dunleavy et al., 2007; Lei & Zhao, 2008; Penuel, 2006). What happens in the realm of learning with these devices when students take them away from the school is an area in need of further study (Grant, 2011). This study builds upon the findings of previous research on learning theory, e-learning, one-to-one laptop programs, and previous research conducted on home use of computers in order to better understand how learning is formed when students take their devices away from the one-to-one school environment.

The benefits of this research are providing a more in-depth understanding of how students shape learning with computing devices. Results from the study can lead to reflection among practitioners in regard to the utilization of computing devices for student learning, and this knowledge can lead to changes in educational practice both inside the classroom and outside of school that better compliment the various learning styles of the students. Furthermore, data gathered from this study may be useful to theorists in determining if there is a need for a new learning theory in the realm of digital technology and e-learning, or if traditional theories sufficiently encompass these learning activities and processes.

Purpose/Aims

The primary purpose of this study is to provide a more in-depth look of how computing devices are used away from school for the purpose of forming learning. The goal of the study is to identify the ways in which students use their computer devices to learn when they are away from the "one-to-one" school environment. Ultimately, the goal of the study is to use data gathered from the participants to better understand how they form learning and how this might impact the way in which we teach. Furthermore, data gathered from the study can provide insight

and understanding into how this learning corresponds with the current learning theories of behaviorism, cognitivism, and constructivism—and the new learning theory of connectivism.

Rationale/Significance

This study is meant to contribute to the larger narrative that is being constructed on the implementation of educational technology initiatives in education. Furthermore, this study is designed to strengthen research on one-to-one laptop programs and student learning by using data on how the computing devices are being used for the purposes of learning when students take them away from the school building. The use of student perspectives is also meant to provide more depth in the narrative of the learners who are taking part in these programs and who are the focus of these initiatives.

Research significance for this topic is found in the growing induction of technology and e-learning into our society and the need for access to this technology and skills to navigate this technology to be a successful citizen. Mossberger et al. (2008) make reference to digital citizenship and state that a "full citizen" in today's society must have access to digital devices and Internet connectivity on a daily basis. The authors claim that this access is a key aspect to economic opportunity, democratic participation, and communication.

Furthermore, with claims made by researchers that the universal presence of technology is significantly changing the way that students learn, research is needed to determine if schools are changing with the students, and if they are, is it appropriate and productive to do so. Education entities recognize that technology is a key component of today's society and will be growing exponentially in the future; they are also aware that there is a gap in access to these resources that exists among their students (Warf, 2012). Educators acknowledge that students

must be able to navigate this digital world. Therefore, to ensure that all students have access to technology, the educational system is put in the position to supply them.

In this light, one-to-one computing programs were developed in order to provide all students within a school setting the access to computing devices. This movement began in the 1980s in Australia and has expanded rapidly around the world, particularly in the United States and the United Kingdom. To better understand how students use the digital resources and Internet connectivity that is provided to them through one-to-one laptop programs, various types of learning must be taken into consideration. Furlong and Davies (2012) call upon researchers to view the various types of learning that take place inside of school and out, cautioning against the perception that formal learning takes place inside the school and informal learning takes place outside of the school. For this purpose, a model is provided by Mocker and Spear (1982) that will be utilized as a starting point to outline the viewing and coding of various types of student learning. Using a matrix based upon student "control" of learning objectives and resources, or lack thereof, the authors provide a framework through which student learning can be viewed: formal learning, nonformal learning, informal learning, and self-directed learning. Furthermore, the focus of the study moves past the more exterior view of learning and examines student acquisition of knowledge through the existing learning theories of behaviorism, cognitivism, constructivism, and connectivism.

Research Question

How do students involved in one-to-one laptop programs utilize computing devices to form learning in out-of-school environments?

Definition of Key Terms

1. Computing Device

For the purposes of this study, a computing device will include any of the following digital devices that are utilized by the participants outside of the school environment: the school-issued laptop device, student personal laptop devices, desktop computers, digital tablets, gaming consoles, and smart phones (phones that have the ability to connect to the Internet).

2. Digital Citizenship

The definition of "digital citizenship" for the purposes of this study is based upon the work of Mossberger et al. (2008). Mossberger states that digital citizenship is "the ability to participate in society online, and 'digital citizens' are those who use the Internet regularly and effectively—that is, on a daily basis" (p. 14).

3. Digital Divide

The term "digital divide" refers to the gap that exists between those who have access to digital technology and the Internet and those who do not. Furthermore, this definition includes the skill gap that exists between those who have access to these resources and those who do not.

4. E-Learning

Khan (2005) defines e-learning as a method of delivering a facilitated learning environment to any individual anywhere at any time, by taking advantage of the properties available in many digital technologies with suitable learning materials for open and flexible learning environments.

Afifi and Alamri (2014) add that the management of this can be done from inside the classroom and outside of the classroom.

5. Formal Learning

Learners have no control over the objectives or means of their learning. The common characteristic that are required for classification as formal learning is that the decisions regarding the objectives (what is to be learned) and the means (how is it to be learned) are made by someone other than the learner (Mocker & Spear, 1982, p. 5).

6. Nonformal Learning

Learners control the objectives but not the means. In this type of lifelong learning, the individual has some responsibility in the decision-making process. Learners make decisions on what is to be learned, but seek help on the how or means of the learning activity (Mocker & Spear, 1982, p. 6).

7. Informal Learning

Learners control the means but not the objectives. The institution maintains control of the goals of the learning activity while permitting or assigning a degree of responsibility for the means for achieving those goals to the learners (Mocker & Spear, 1982, p. 8).

8. Self-directed Learning

Learners control both the objectives and the means. Self-directed learning, as defined here, represents the ultimate state of learner autonomy, i.e., the learner exercises control over and major responsibility for choosing both the goals and the means of the learning. Broadly, the definition suggests that the learner decides what and how to learn, but that other decisions, such as when and where to learn and how much to learn at any given time are implicit. The learner not only selects, but may also reject, add, or change resources at will; decides to continue or terminate the project; and finally determines the satisfaction or adequacy of the outcomes (Mocker & Spear, 1982, p. 11).

9. One-to-one Laptop School / Program / Ubiquitous Computing Program

Also known as "ubiquitous computing," one-to-one laptop programs get their name from the ratio of digital laptop devices to students. For the purposes of this study, the reference of one-to-one laptop programs will describe school programs in where portable laptop or tablet devices have been issued to all students for both school and home use. Penuel (2006) expounds upon this definition with the required provision of "contemporary productivity software" which enables students to access the Internet through the school's wireless networks, and that the program must have a focus on using the devices to help students complete academic tasks.

Limitations of Study

One of the primary limitations of the study lies in the gap between the researcher and the participants of the study. As the interviewer, the researcher will be the primary data collection tool; and as such, the researcher will continuously attempt to navigate between his own personal biases and experiences and the interpretation of the subjective experiences of the participants. Furthermore, his own practice in qualitative research is very limited and as such will not reflect that of an expert with vast amounts of experience.

Challenges will arise in the generational divide that exists between the researcher and the participants of the study. The participants of the study are considered "digital natives" as they were born into a world that has always immersed them in digital technology. Conversely, the researcher is considered a "digital immigrant" since his generation has to assimilate to the digital world that grows around them. These aspects contribute to variations in the perception of digital technology, and will be a limiting factor when interpreting meaning from the data collected in the study.

The length of the study is also a limiting factor. The study will take place over the course of 3 months in which participants will partake in a survey and one interview 30 to 45 minutes in duration. Because of the short time frame, the study will provide a brief glimpse into the learning constructed by students away from the school environment. Consequently, the study will present a snapshot of the learning practices of the selected participants of the study.

Yet another limitation of time is that only participants who are in their senior year of high school and are 18 years of age or older are eligible to participate in the study; this criteria is very limiting and only captures a small percentage of students in the district who are participating in the one-to-one laptop program.

Finally, due to the variety of types of technology that the participants use when they are away from school, it will be difficult to focus only on the actual devices that are provided by the school and not all computer devices that they come in contact with on a frequent basis. Therefore, data collected for the study will be representative of all devices that the participants have access to and not only the school-issued laptop device.

Design and Methodology

The study will take place at Hadley High School in Harrisonville, Indiana. Hadley High School is located on the suburban fringe of a Midwestern city and has a student population of 1,350. The site has been selected for the study first and foremost for their one-to-one laptop program and secondly for greater access to participants.

Participants. Participants for the study had to meet the criteria of being in their senior year at Hadley High School and be 18 years of age or older. Those who met these requirements (approximately 200) were offered the opportunity to partake in a survey. The survey provided feedback from the participants regarding their at-home use of the digital device distributed to

them by the school through the one-to-one laptop program, as well as other digital devices that they have access to when they are away from the school environment. Based on the survey results, students were selected in regard to their reported amounts of time spent using digital devices when they were away from the school environment, and for the range of purposes in which they used the digital devices. In addition, these students were asked to participate in a single 30- to 45-minute interview.

The 12 participants of the study were selected to provide an even number of males and females. This process was based upon a large body of research that supports that males and females use technology differently.

Data collection. Data collection first took place via the voluntary student survey which will be designed using the program "Qualtrics." The survey contained 10 questions that were designed to elicit information about the participants' computer use when away from the traditional school environment. The survey contained multiple choice questions aimed at measuring the amount of time each student spends using his or her laptop device and for what purposes the student uses it. Based on the survey data, 12 students were be selected according to those who reported using the laptop device at home for a significant amount of time each week (the more time, the more likely a student is to be chosen) and those who also specified using it for a wide range of activities.

The second data collection occurred when the 12 students were selected to participate in a 30- to 45-minute standardized open-ended interview. Students were asked about various aspects of their laptop use when they were away from school. More specifically, students were asked how they used their devices for assigned schoolwork, personal interests, and entertainment.

During the interview, students were asked structured interview questions that allowed for open-ended answers that were followed by probes. The data from these interviews were then gathered and coded under the categories of formal, nonformal, informal, self-directed learning, and other emergent themes.

Data analysis. LeCompte and Schensul (1999) discuss taking large amounts of data from research and breaking it down into manageable information that can be used to explain what the researcher has studied. The initial data analysis for this study will come from the questionnaire survey that is issued in January of 2015. These surveys will first be analyzed by the amount of time that students report spending on their laptop devices outside of the school environment. The surveys will then be examined for the various ways in which participants report using the devices. Then, a group of 12 (6 males and 6 females) will be selected to participate in a 30- to 45-minute standardized open-ended individual interview.

Chapter 2: Review of Literature

The following literature review is meant to provide a synthesis and analysis of theory and scholarly research in and around the areas of one-to-one laptop / ubiquitous computing initiatives and the shaping of student learning with computing devices. The review of literature begins with a description of the methodology used for its construction, and then furnishes a background on the learning theories of behaviorism, cognitivism, constructivism, and connectivism which are used as the conceptual lens for the study. A learning model provided by Mocker and Spear (1982) will be introduced before proceeding to the substantive literature sections of the review.

The literature is divided into nine essential sections. Section 1 looks at the growing induction of digital technology into our society and the need for student access in order to fully participate as citizens. The "digital divide" that exists between students who have reliable access to digital technology and those who do not, and the impact that this gap has upon their ability to function as students and citizens is examined in section two. Section 3 views the history of one-to-one laptop programs both in the United States and internationally. One-to-one laptop programs and teacher pedagogy are considered in section four. Section 5 evaluates one-to-one laptop programs and student behavior while section six assesses one-to-one laptop programs and student achievement. Section 7 describes student home computer use to provide research in regard to how students might use digital devices at home. Research in regard to student learning that is constructed with and through digital devices is examined in section eight, and finally, section 9 reviews gender and computer use.

Literature Review Methodology

In effort to provide a comprehensive review of literature in regard to the purpose of this study various electronic databases were used (EBSCO, JSTOR, etc.) along with common search

engines (Google Scholar, etc.), book ordering sites (Amazon), and government websites for current available data. All attempts were made to find resources that included recent studies, major historical studies, heavily cited studies, and studies that meet the "peer reviewed" criteria. Studies were also selected that viewed various aspects of computer use and one-to-one laptop programs.

The researcher focused his searches primarily upon students at the secondary level, specifically at the high school grade levels. Key search terms that were used for school computer programs included *one-to-one laptop programs, ubiquitous computer programs, school technology initiatives* and *e-learning.* Searches were also conducted in the realm of computer use including *student home computer use, student learning with computers, students and digital technology, digital divide, technology gap,* and *digital citizenship.* Lastly, key search terms for student learning included *formal learning, informal learning, self-directed learning,* and *incidental learning.*

From the searches, various articles, books, and studies were examined to find the most relevant, recent, and comprehensive information that meet the peer reviewed criteria. Each of these were read and then organized in order of initially perceived importance. Resources that were organized as "highly important" were read again and analyzed in more depth. Specific data and key quotes were copied and placed into the electronic database called Endnote.

Learning Theory: Behaviorism, Cognitivism, Constructivism, and Connectivism

In his paper, Alzaghoul (2012) views e-learning through the lens' of behaviorism, cognitivism, and constructivism, stating that the implementation of all three methods in the online learning process can better serve the individual learning styles of students. He recognizes that "learning theory" is an attempt to understand the complex learning process of people and

animals and states that "learning theories provide empirically-based accounts of the variables which influence the learning process, and provide explanations of the way in which that influence occurs" (p. 27). In order to establish a background in regard to how students learn, a review of the basic learning theories of behaviorism, cognitivism, and constructivism will be provided. Following the introduction to the more traditional learning theories, the more recently established theory of connectivism will be examined, as some proponents claim that it is better related to student learning in the new age of digital technology.

In his research on academic motivation and self-efficacy, Schunk (1991) defines learning as "an enduring change in behavior, or in the capacity to behave in a given fashion, which results from practice or other forms of experience" (p. 2). He views learning theory through the lens of a matrix that questions: How does learning occur? Which factors influence learning? What is the role of memory? How does transfer occur? and What types of learning are best explained by the theory? Ertmer and Newby (1993) attempt to inform educational designers of the three basic learning theories (behaviorism, cognitivism, and constructivism) so that practical applications can be made in instructional design. They utilize Schunk's analysis of learning theories to posit that learning takes place along a "low-to-high knowledge continuum" from:

> 1) being able to recognize and apply the standard rules, facts, and operations (knowing what), to 2) being able to extrapolate from these general rules to particular, problematic cases (knowing how), to 3) developing and testing new forms of understanding and actions when familiar categories and ways of thinking fail (reflection-in-action). (p. 60)

Ertmer and Newby connect the learning theories of behaviorism and cognitivism to the more objectivist epistemology in that the world is real, external to the learner; with the goal of instruction being to "map" the structure of the world onto the learner (Jonassen, 1991). The authors then claim that learning continues along to a more constructivist theory where

knowledge "is a function of how the individual creates meaning from his or her own experiences" (Jonassen, 1991, p. 10). With this in mind, definitions and descriptions of the above mentioned theories will be provided through Schunk's five-pronged lens so that they may be referenced and examined when analyzing the data from the study. Furthermore, the researcher will primarily use the work of Ertmer and Newby (1993) to view the learning theories in light of Schunk's matrix.

Behaviorist Learning Theory

In his foundational text on radical behaviorism, B. F. Skinner (1974/2011) recognizes John B. Watson as the "first explicit behaviorist" in regard to his 1913 work, *Psychology as the Behaviorist Views It* (p. 5). Watson's theory is often referred to as *classical S-R behaviorism,* as it is based upon the fundamentals of stimuli and response; the "habit" is recognized as principal unit of analysis (Moore, 2012) and relies upon the repetition of an act that is elicited or provoked by an action. Alzaghoul (2012) adds that the behaviorist "sees the mind as a black box, in the sense that all stimulus can be observed quantitatively, totally ignoring the effect of thought processes occurring in the mind" (p. 27).

Skinner (1974/2011) claims that much of behaviorism is misunderstood as early beginnings placed a significant focus on animal behavior and not human behavior, and that early behaviorists said little in regard to purpose, spontaneity, or creativity. Skinner argues that it has been difficult for the theory of behaviorism to overcome previous misunderstandings due to the lack of attempts of science, in general, to provide explanations to those outside of the scientific community. In his book *About Behaviorism,* Skinner states that major problems in the world can be "solved only if we improve our understanding of human behavior" (p. 8). In behaviorism, learning can be concisely defined as a change in the behavior of the individual. Behaviorism

viewed through Schunk (1991) asks the five questions: How does learning occur? Which factors influence learning? What is the role of memory? How does transfer occur? and What types of learning are best explained by the theory?

How does learning occur? Behaviorism is described by Ertmer and Newby (1993) as learning that equates with changes in observable performance, and states that "learning is accomplished when a proper response is demonstrated following the presentation of a specific environmental stimulus" (p. 48). The authors go on to claim that the key elements of the behaviorist theory is the "stimulus," the "response," and the connection between the two. Ally (2004) further reports that what is learned is based upon what is observed as we cannot assess the learner's mind.

Which factors influence learning? Ertmer and Newby (1993) note that in the behaviorist theory, the primary focus is placed upon environmental conditions. The authors contend that "behaviorists attempt to prescribe strategies that are most useful for building and strengthening stimulus-response associations, including the use of instructional cues, practice, and reinforcement" (p. 49). Ireland (2007) recognizes the stimuli of rewards and punishment and the role that they play upon the learner whom is considered a "tabula rasa," or blank slate. Ireland proclaims that behavior is changed or "learned" when stimuli are introduced to the individual and a response is evoked. Ireland states that both positive and negative stimuli lead to an increase in the repetition of response behavior, thus leading to a change in the behavior of the learner.

What is the role of memory? While Ertmer and Newby (1993) inform that the role of memory is not often addressed in the study of behaviorism, Ireland (2007) references the role of memory as the "hardwiring" in the learner's brain that occurs when repeatedly exposed to

stimuli. In arguing that technology has brought about a new culture that has reshaped the way that we are learning, Ireland states that the most "influential" rewards and punishments are "remembered" by the learner through programmed responses to the positive or negative stimuli.

How does transfer occur? Ertmer and Newby (1993) establish that in behaviorism, transfer is achieved when a learner is able to respond to a new stimuli based upon previous experiences with similar stimuli. The authors note that the stimuli must be extremely similar, if not identical, in order for successful transfer to occur.

What types of learning are best explained by the theory? Ertmer and Newby (1993) reference Winn (1990) in that the behaviorist approach to learning in education has been successful in getting students to recall facts, define and illustrate concepts, apply explanations, and "automatically" performing a specified procedure. Furthermore, Ertmer and Newby (1993) state that the job of a teacher is to (a) determine which cues can elicit the desired responses; (b) arrange practice situations in which prompts are paired with the target stimuli that initially have no eliciting power, but will be expected to elicit the responses in the "natural" (performance) setting; and (c) arrange environmental conditions, so that students can make the correct responses in the presence of those target stimuli and receive reinforcement for those responses.

Ally (2004) views online learning through the theories of behaviorism, cognitivism, and constructivism to promote the use of focused and intentional learning strategies within online environment. He describes the behaviorist school as the following:

1. Learners should be told the explicit outcomes of the learning so that they can set expectations and can judge for themselves whether or not they have achieved the outcome of the online lesson.

2. Course designers have to define sequences of instruction using conditional or unconditional branching to other instructional units and pre-determining choices within the course.
3. Learners must be tested to determine whether or not they have achieved the learning outcome. Online testing or other forms of testing and assessment should be integrated into the learning sequence to check the learner's achievement level and to provide appropriate feedback.
4. The behavioristic approach for learning suggests to demonstrate the required operation, procedure or skill, and to break it down into its parts with appropriate explanation before learners are expected to copy the desired behavior. Learners are supposed to build proficiency from frequent review or revision with check tests at strategic points or repeat practice with feedback. (p. 28)

Cognitivist Learning Theory

Cognitivism, as secondly positioned by Ertmer and Newby (1993) along the "low-to-high knowledge continuum," is described by Jonassen (1991) as being more involved with *what* learners know and *how* they come to acquire it. Alzaghoul (2012) references Skinner's "black box" and states that in the school of cognitivism, the box should be opened and understood. Ertmer and Newby note that the cognitive theory moves away from the observation of "overt behaviors" and places more emphasis on the cognitive process, such as "thinking, problem solving, language acquisition, concept formation and information processing" (p. 50). And, while the "cognitive" learner plays a very active role in the learning process, the learner's previous experiences and environment are critical for learning to take place. Here, the researcher views the cognitive learning theory through Schunk's five key questions.

How does learning occur? The cognitive learning theory requires the creation of learning environments that allow and encourage individuals to make connections with previously learned material (Ertmer & Newby, 1993). Information is organized in a manner that best enables the learner to draw from previous experiences, so that they may learn new material. Ertmer and Newby (1993) state that "cognitive theories focus on the conceptualization of students' learning processes and address the issues of information is received, organized, stored, and retrieved by the mind" (p. 51). The authors go on to recognize Jonassen's (1991) claim that learning in the cognitivist theory focuses on what the learner "knows" and how they come to "know" it, versus what the learner "does."

Which factors influence learning? Ertmer and Newby (1993) recognize the role that environmental conditions play in the learning process of cognitivism. They reference the idea of guiding student learning through the use of examples in which the learner is previously familiar, as well as the explanation of instruction and expectations by the facilitator of the learning process. An emphasis is also placed on the role of the facilitator in providing corrective feedback to the learner. Ertmer and Newby point out that a defining characteristic of cognitivism that separates itself from the behaviorist theory is in regard to the role of the "active learner." The authors state, "the cognitive approach focuses on the mental activities of the learner that lead up to a response and acknowledge the process of mental planning, goal-setting, and organizational strategies" (p. 51). Furthermore, Winn (1990) places an emphasis on individuality of the learner in the cognitive process and gives importance to the learner's values, beliefs, thoughts, and attitude toward what is being learned.

What is the role of memory? In the cognitivist theory the role of memory is of greater importance than in behaviorism. Ally (2004) states that "cognitivists see learning as an internal

process that involves memory, thinking, reflection, abstraction, motivation, and meta-cognition" (p. 4). Memory was previously conceived as a conditioned response; however, in cognitivism the learner and his or her memory is "meaningful." Ertmer and Newby (1993) claim that "learning results when information is stored in memory in and organize and meaningful manner" (p. 52).

How does transfer occur? In regard to transfer, Schunk (1991) references the role of memory and how information is stored. Here, a key aspect of transfer occurs when a learner is able to utilize previously gained knowledge (memory) in a new environment and context. Ertmer and Newby (1993) state, "Prior knowledge is used to establish boundary constraints for identifying the similarities and differences of novel information. Not only must the knowledge itself be stored in memory, but the uses of that knowledge as well" (p. 52).

What types of learning are best explained by this position? Schunk (1991) recognizes that the cognitivist theory allows for more depth in the learning process, and for more complex processes such as reasoning and problem solving. In this regard, Ertmer and Newby (1993) identify framing, outlining, mnemonics, concept mapping, advanced organizers, as well as the use of analogies and metaphors as instructional strategies used in cognitive learning method. With communication and knowledge transfer being the primary focus, the authors recognize that while the behaviorist theory and cognitivist theory share the same objectives, the cognitivist theory stresses "efficient processing strategies" (p. 53). Ertmer and Newby note that techniques used by both behaviorist and cognitivist to be able to communicate and transfer knowledge efficiently are *simplification* and *standardization*. In this capacity, knowledge is simplified and structured into "building blocks" that can be more easily comprehended. In regard to the implications for online learning in the school of cognitivism, Alzaghoul (2012) provides the following:

1. Online learning materials should include activities for the different learning and cognitive styles.
2. The teaching strategy should enhance the learning process by facilitating all sensors, focusing the learner's attention by highlighting important and critical information, reasoning each instruction, and matching the cognitive level of the learner.
3. The instructional designer should tie up to new information with existing information from long-term memory using advanced organizers to activate existing cognitive structures.
4. The learning content should be chunked to prevent cognitive overload. Exceeding a number of five to nine items to learn, linear, hierarchal, or spider-shaped information maps should be provided. (p. 28)

Constructivist Learning Theory

Von Glasersfeld's (1995) book provides a theoretical account of radical constructivism in the field of mathematics education. He states that constructivism replaces the "traditional concept of truth . . . with the concept of viability" (p. 8). In looking at the role of learning theory in instructional systems technology, Jonassen (1991) describes this viability in that each individual creates or constructs his or her own reality through their experiences with the world. In this theory of learning, the learner is just as important, if not more so, than the environment and "truth" that surrounds him or her. Here the constructivist moves away from the behaviorist and cognitivist in that there is no objective truth or knowledge, but yet a truth that is as individual as the student who is constructing it. Ally (2004) references the learner as an "active learner" and states that "knowledge is not received from the outside or from someone else:

rather, it is the individual learner's interpretation and processing of what is received through the senses that create knowledge" (p. 11).

How does learning occur? To explain the occurrence of learning, Ertmer and Newby (1993) site the Bednar, Cunningham, Duffy, and Perry (1992) position that learning is the process of creating meaning from experience. Constructivism places a foundational importance upon the learner and his or her "unique reality" that he or she brings to the learning process (Jonassen, 1991). Ertmer and Newby state that in the theory of constructivism, "the mind is believed to be the source of all meaning . . . individual, direct experiences with the environment are considered critical. Constructivism crosses both categories by emphasizing the interaction between these two variables" (p. 55). Ertmer and Newby (1993) note that constructivists place critical importance upon the learner's own interpretations of experiences with the world around him or her, stating that "humans create meaning opposed to acquiring it" (p. 55). Because of this, the authors note that change is always possible in the learning process; as the individual is constantly changing, so is the world around the individual.

Which factors influence learning? The key factors that influence learning in the constructivist paradigm are the learner and the world around the learner, or any "environmental factors." Ertmer and Newby (1993) note that it is the interaction between these key variables in which learning takes places and knowledge emerges. For this purpose, the authors note that it is of critical importance that learning activities are structured around tasks that are relevant and "real" to the learner's "lived experiences" (p. 56).

What is the role of memory? In the constructivist theory, memory is always being constructed by the learner and therefore is always subject to change. Ertmer and Newby (1993) therefore state that it is not the goal of constructivism that learning is recalled by the memory,

but rather to draw upon past memories to inform newly constructed experiences: “The emphasis in not on retrieving intact knowledge structured, but on providing learners with the means to create novel and situation-specific understandings by assembling prior knowledge from diverse sources appropriate to the problem at hand” (p. 56).

How does transfer occur? The constructivist argues that transfer occurs when the learner is engaged in “authentic tasks.” Ertmer and Newby (1993) state that if the learning process is “decontextualized,” that transfer is unlikely. The authors posit that “the ultimate measure of learning is based on how effective the learner’s knowledge structure is in facilitating thinking and performing in the system in which those tools are used” (p. 57).

What types of learning are best explained by this position? Ertmer and Newby (1993) note that constructivists do not believe that learning can be organized in the form of a hierarchy, or that learning can be organized independently from the content and context in which the learning is taking place. However, the authors state that while constructivist learning can be effective in learning basic skills, it is more often associated with higher order learning activities. Jonassen (1991) does provide a hierarchal order by placing learning activities into the three categories of “introductory, advanced, and expert,” and states that constructivist learning environments are “most effective for the stage of advanced knowledge acquisition” (p. 142). Here Jonassen states that advanced knowledge must be acquired in order to “solve complex, domain- or context-dependent problems” (p. 143). Classroom representation of this model utilize student-centered activities such as experimentation, collaborative learning, mentoring / modeling, problem-based learning, and discussion. Alzaghoul (2012) references what constructivist learning “looks like” in an online environment:

1. To enforce learners constructing their own knowledge, instructors have to go to interactive online instructions.
2. Learners should be given control of the learning process. There should be a form of guided discovery where learners can make their decision on learning goals, but can also use some guidance from the instructor.
3. Instructors should focus on interactive learning activities as collaborative and cooperative learning should be encouraged to facilitate constructivist learning.
4. Learning should be made meaningful and illustrative for learners by including examples and use cases for theoretical information. (p. 29)

Connectivist Learning Theory

The learning theory of connectivism was introduced by Siemens and Downes in 2005. S> Downes (2005) states, "At its heart, connectivism is the thesis that knowledge is distributed across a network of connections, and therefore that learning consists of the ability to construct and traverse those networks" (p. 1). Siemens's (2005) paper argues that theories can only evolve with a changing environment so much before the theory is no longer applicable to the subject that it is intended to explain; he asserts that connectivism is being driven by the understanding that decisions are based on rapidly altering foundations, and that individuals are continually acquiring new information, primarily through a digital medium. He argues that there is a need to move beyond the traditional learning theories of behaviorism, cognitivism, and constructivism because with the influx of technology has come a fundamental change in the way that we think and learn, and the theories of old do not take into consideration the role of organization and network structures in the learning process.

> Siemens states: the natural attempt of theorists is to continue to revise and evolve theories as conditions change. At some point, however, the underlying conditions

> have altered so significantly, that further modification is no longer sensible. An entirely new approach is needed. (p. 3)

He contends that "know how" and "know what" are being replaced by "know where" for the practice of finding information and knowledge that is needed.

In the connectivism theory, Siemens (2005) places an emphasis on forming connections with not only ourselves and our friends, but also with organizations and databases. Kop and Hill (2008) reference the importance of learning communities in the connectivist model and recognize Siemens' and Downes's concept of "nodes" or learning communities within larger networks. Siemens notes the principles of connectivism as:

- Learning and knowledge rests in diversity of opinions
- Learning is a process of connecting specialized nodes of information sources
- Learning may reside in non-human appliances
- Capacity to know more is more critical than what is currently known
- Nurturing and maintaining connections is needed to facilitate continual learning
- Ability to see connections between fields, ideas, and concepts is a core skill
- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities
- Decision making is in itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision. (p. 4)

Even though connectivism is a new theory and is not covered in Ertmer and Newby's (1993) analysis of learning theory, it can still be viewed through the five key questions that have been provided by Schunk (1991).

How does learning occur? Learning in this theory is built around the concept of connecting information and knowledge through various means, including learning communities, databases and organizations. S. Downes (2005) writes a paper to address the concept of connective knowledge as being "probabilistic." The author notes that connective knowledge should be thought of, and treated, as a new form of knowledge. He states that "knowledge is, on this theory, literally the set of connections formed by actions and experience" (p. 80). It is unique in that the connectivist theory addresses not only the learner and knowledge, but also defines the "organization" as a learning organism. Siemens (2005) claims that "learning can reside outside of ourselves, within in an organization, or a database) . . . [and] is focused on connecting specialized information sets, and the connections that enable us to learn more are more important than our current state of knowing" (p. 2). Siemens affirms that the individual is where learning begins; however, what is of critical importance is that knowledge is shared throughout organizations and networks and then feedback is received and distributed again in a cyclical manner so that the organization is constantly evolving and both the individual and the organization are constantly learning. In an attempt to better understand evolutionary systems and constructivism, Rocha (1998) refers to organizational learning systems and states that for learning to occur the system must "be informationally open, that is, for it to be able to classify its own interaction with an environment, it must be able to change its structure" (p. 4).

What factors influence learning? Connectivism asserts that one of the key aspects of its origin is the current phenomenon of rapidly changing and evolving information. Siemens (2005) notes that new information is continually being acquired by the learner, and Gonzalez (2004) speaks to the "half-life" of knowledge by stating that today's learners are faced with an environment in where information is quickly obsolete as it has the ability, through technology

and connectivity, to change and evolve faster than ever before in history. Thus, learners must be connected to information organizations so that they are current in their knowledge and adding to the knowledge continuum. Furthermore, Siemens states that connectivism requires a diversity of opinions. The author notes that knowledge cannot exist in a single mind and therefore requires a diversity of opinions and experiences to collectively contribute.

What is the role of memory? Siemens (2005) contends that pattern recognition plays an important role in connectivism and that it is a critical skill to be able to see connections between ideas and concepts. Siemens states that

> knowledge does not only reside in the mind of an individual, knowledge resides in a distributed manner across a network . . . learning is the act of recognizing patterns shaped by complex networks. These networks are internal, as neural networks, and external, as networks in which we adapt to the world around us. (p. 10)

How does transfer occur? S. Downes (2005) proclaims that in connectivism, "there is no real concept of transferring knowledge, making knowledge, or building knowledge. Rather, the activities we undertake when we conduct practices in order to learn are more like growing or developing ourselves and our society in certain (connected) ways" (p. 80). However, others declare that transfer does take place in the realm of connectivism when nodes of information are connected and added. At an international scientific conference, Marhan (2007) argues in favor of a new learning theory in connectivism, stating that a network is defined as the connections between entities linked in order to share resources. A network consists of two or more nodes. A node is a connection point to a larger network: learning communities, information sources, and individuals can all be classified as nodes.

In an attempt to more critically analyze the theory of connectivism, Kop and Hill (2008) view the new theory along with behaviorism, cognitivism and constructivism in order to better

determine if a new theory is needed. The authors assert that "with connectivism, the formation of connections between nodes of information (i.e., networks) constitutes knowledge—and in addition, connectivism posits that 'the ability to construct and traverse those networks' (Downes, 2007) comprises learning" (p. 6). Stephenson (1998) speaks to transfer in regard to experience by saying, "Experience has long been considered the best teacher of knowledge. Since we cannot experience everything, other people's experiences, and hence other people, become the surrogate for knowledge" (p. 1). In this same way, nodes and networks act as "people" as they possess information and "experiences" that can be shared in the "surrogate" form. Bessenyei (2008) argues that students can greatly improve their learning of any subject through the interaction with networks and virtual communities.

What types of learning are best explained by this position? In Ireland's (2007) learning theory matrix, the author states that the types of learning that are best explained by the theory of connectivism are complex learning that is rapidly changing and is drawn from a broad array of diverse sources. Downes (2005) specifies that in connectivism, "deep thinking" and "creating understanding" are the same as the connection making process. Siemens (2005) claims that one of the key principals of connectivism is that "decision-making is itself a learning process." And that "choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality" (para. 25).

In their paper, Pettenati and Cigognini (2007) review personal learning environments and e-learning practices; the authors recognize the "new role" of learners in connectivism, calling them "prosumers." The authors identify a prosumer as a more aware learner who is a "strong user" of social software, having the ability to consume and produce resources within various communities. In regard to the learner of today, the authors state,

> It's a story about community and collaboration on a scale never seen before. It's about the cosmic compendium of knowledge Wikipedia and the million-channel peoples network YouTube and the online metropolis [Facebook]. It's about the many wresting power from the few and helping one another for nothing and how that will not only change the world, but also change the way the world changes. (p. 6)

Pettenati and Cigognini (2007) recognize learning in this manner as "e-learning 2.0" or learning 2.0. They state that this type of learning:

1. Is a type of learning which is tied to the interests of the learners.
2. It is an immersive learning which is acquired by doing, realized not only in the class but also in appropriate environments.
3. It is a type of learning in which web 2.0 technologies connect the learners to the rest of the world. (p. 6)

McFedries (2006) establishes that the characteristics of learning in a Web 2.0 environment include: content that is user-created and maintained; combines data from different sources; and one in which the services get better as the number of users increases. And Pettenati and Cigognini (2007) report the following Web applications that exist to the Web 2.0 learner: social networking, search engines, blogs, peer production news, Wikis, instant messaging, and podcasting. Classroom activities in the learning environment include, but are not limited to:

- Learner is at the center of the learning experience
- Learner determines the content of the learning
- Learner develops the ability to find relevant information and filter out extraneous information
- Learning is a cyclical process (connects to a network to share and find new information; modifies beliefs on the basis of new learning; and connects to a

network to share these realizations and find new information once more; Giesbrecht, Geraerts, & Merckelbach, 2007)

E-Learning

Afifi and Alamri (2014) conducted a study in order to determine the design quality of e-courses. The authors have identified effective principles of e-learning courses and recognize e-learning as a style of learning that utilizes electronic media on the Internet to provide e-content (lectures, tutorials, discussions, exercises and tests). The authors state that the management of e-learning can take place inside of the learning institution or outside of the learning institution, as well as can take place at anytime and anywhere. Brown and Voltz (2005) add to this description of e-learning, stating that e-learning can exist in various forms, including learning that incorporates face-to-face aspects, distance learning, and blended models that incorporate a combination of the two.

Developers and proponents of e-learning claim that this style of learning is much more than utilizing computing devices and the Internet to deliver traditional learning materials; they state that e-learning brings about a significant and fundamental change in the learning process in which educators must adapt in order to meet the needs of learners of today and tomorrow (Afifi & Alamri, 2014; Kop & Hill, 2008; Mossberger et al., 2008). Kop and Hill (2008) note that young people who have been consistently exposed to e-learning throughout their lives will begin to outnumber those who have grown up with "books and pen and paper . . . thus causing friction in institutions and class rooms" (p. 11).

In their paper highlighting successful e-learning practices, Brown and Voltz (2005) propose six core aspects of e-learning: activity, scenario, feedback, delivery, context, and impact. The authors stated that a rich activity is one that "opens up opportunities for action rather than

directs students down a prescribed pathway" (p. 4). The authors place an importance on the activity's ability to provide the learner with autonomy in choices of learning experiences. The activities are meant to be complex and engaging for the learners.

Secondly, Brown and Voltz (2005) discuss the aspect of "scenario." The scenario is the vehicle in which is provided for the learning objectives. The authors state that the scenario drives the motivation to undertake the educational activity if the learning is to be "memorable and considered valuable" (p. 4). There are times when the scenario is straightforward, such as basic assignments and learning activities, and there are times when the scenario is more elaborate, making use of "humor, imagination, reward, anticipation, or drama to enhance the activity" (p. 4). The authors believe that when the learning scenarios are more complex and interesting, that the students are more engaged. Brown and Voltz specifically note the efforts and successes of the gaming industry, stating that educators could learn from the designers of entertainment products who have successfully engaged learners in a "virtual world that they find compelling" (p. 4).

The third aspect of e-learning is that of "feedback." Here the authors focus on the aspects of timely reflection, saying that e-learning provides the ability to give more feedback, more quickly. The authors claim that "effective use of feedback will enable an e-learning design to set up a dialogue within which the student participates, without which designs may simply become plans for broadcasting content" (p. 5).

Fourth is "delivery." Here the authors briefly claim that the "appropriate delivery of e-learning should aim to maximize the engagement of the student with the activity, enable the communication of stimulating contexts, and maximize opportunities for feedback and reflection" (p. 6). The authors state that there are times when non-digital activities are more appropriate for delivery as they may be more "simple" and appropriate.

Fifthly, the authors discuss the aspect of "context." The authors describe the context as the situation in which the e-learning is to take place. Brown and Voltz (2005) state that

> the elements of the activity, scenario, and feedback need to take into account the users' profiles and the delivery element needs to consider the technical infrastructure. However, additional contextual considerations include the institutional objectives of the e-learning program, the role and skills of any instructor, longevity of the resources, and cultural sensitivities. (p. 6)

Lastly, the authors discuss the aspect of "impact." The impact of e-learning references the influence that the learning activity will have on the learner and the "broader community into which it will be implemented, and the environmental influence of its development and use . . . in short, the extent to which the content benefits the user . . . in short, the extent to which people other than the learner will benefit" (p. 6).

The previous six aspects of e-learning, contributed by Brown and Voltz (2005), provide us with a lens in which to view various aspects of e-learning in order to better understand the concept, process, and influence that it has on the learner and the educational environment. They will also help to determine the benefits of e-learning if used correctly, and the detriments of e-learning if used incorrectly.

Afifi and Alamri (2014) note that if implemented correctly, e-learning allows students to become more involved as they have the ability to make decisions in regard to the content and how they engage in the learning activity. The authors reference Upadhyay's (2006) and Yucel's (2006) work on mobile educational systems in regard to the learning advantages gained through e-learning:

- individualization of learning
- flexibility in activities' schedule
- learning anywhere at any time

- freedom of professors to communicate with students
- participation in the learning community via the network
- controlled learning, as providing learning materials via the Internet makes it easy for the learner to navigate and choose his/her appropriate sequence
- includes many diverse learning media that enhance learning
- provides a social learning environment available through online discussions, where interaction with other learners is available via electronic discussion lists
- provides opportunities for learner-centered learning, which is consistent with the learning philosophies and theories of modern learning
- provides a great variety of sources of information in various formats that helps to dissolve or minimize differences between students. (p. 131)

However, Afifi and Alamri also state that if instructional design for e-learning is poor, such as simply placing traditional content on a website, then many shortcomings may follow, including:

- the lack of real interactivity in their e-courses
- the lack of employing synchronous and asynchronous communication tools in a way that would achieve interactivity
- the absence of support and immediate feedback to learners during the learning process
- navigational difficulties and poor design of web pages, which lead to intellectual exhaustion for the learner. (p. 129)

Because of the rapid growth and inclusion of technology and the room for error in the design and implementation of e-learning curriculum, Kop and Hill (2008) report that educators must "closely follow and influence the developments and the debates, and seriously research

how their institutions can evolve using the emerging technologies to their and their learner's advantage" (p. 11). The author's argue that educators need to make full use of the technology that they have access to, as well as become "critical engagers"—so that they remain relevant.

Student Learning Activities: Formal, Informal, Nonformal, and Self-Directed

A better grasp of learning theory and e-learning allows for a better understanding of how students use the computing devices that they have for various types of learning. Furlong and Davies (2012) conducted a large-scale mixed methods study in the UK in order to better understand "the role of new technologies in young people's lives" (p. 48). The authors call upon researchers to view the various types of learning that take place inside and outside of school cautioning against the perception that formal learning only takes place inside the school and informal learning only takes place outside of the school.

In studying technology delivered instruction, Ally (2004) cautions against focusing on the technology and not the learner and the learning process. He defines online learning as the use of the Internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience.

In their book, Coombs, Ahmed, and Israel (1974) utilize a 1971 study on education in rural and impoverished areas to view nonformal learning programs of farmers, artisans, craftsman, and entrepreneurs. The authors define formal learning as an "institutionalized, chronologically graded and hierarchically structured education system, spanning lower primary school and the upper reaches of the university" (p. 8). The same authors describe informal learning as the "lifelong process by which every person acquires and accumulates knowledge, skills, attitudes and insights from daily experiences and exposure to the environment" (p. 8).

Various studies conducted on one-to-one laptop initiatives have attempted to identify how the students use the device and the types of learning that occur when they do. Kent and Facer's (2004) paper studied 1800 children in England over the course of 2 years and uses young student's access to computers at home and away from school to determine how use differs in the areas of school and home. Given the data, the authors suggest further research to be done in the realms of the formal and informal learning that take place when students interact with their laptop devices. The authors note the value in determining how students choose to use their computer devices and learn informally. Furthermore, the authors place importance on what practices educators incorporate in the formal environment that will engage students. Kent and Facer call for research in the area of what formal practices are used in the students' schools and what formal practices are being used at home. The authors are careful to note that both formal and informal learning can and do take place in the home and school setting. Formal learning is not restricted the school environment and informal learning is not restricted to the home or "outside" environment. Furlong and Davies (2012) necessitate a close and careful examination of what we consider to be "formal" and "informal" learning. They warn against classifying learning that takes place inside the school as formal and learning that takes place outside of the school as informal and state that making that simple distinction is misleading.

Lei and Zhao (2008) studied one-to-one laptop programs in Maine in order to determine how students use their devices, the impact that the devices had, and the perceptions of students, teachers, and parents in regard to the computer program. The authors claim that the presence of one-to-one laptop initiatives has expanded the learning opportunities for students both in formal and informal manners. Through their ubiquity, the authors affirm that these programs have provided students with around the clock access that "enriched student learning experiences,

expanded their horizons, and opened more opportunities and possibilities." Lei and Zhao surveyed students to determine how often they used their computer devices and found that 7.7% of the students spent less than 1 hour a day on their laptops, 24.6% of the students spent about 1–2 hours a day, 30.8% of the students spent about 2–3 hours a day, and 36.9% of them spent more than 3 hours a day on their laptops. When determining how students use the laptop devices during this time, Lei and Zhao discovered that most students (81.4%) used their laptops to do homework, followed by searching information for school work (71.4%), emailing (65.8%), surfing online for entertainment (58%), chatting online (51.1%), and working with specific software (50.2%). About half of the students used computers to play games (48.1%) and 11.3% of students created websites.

Penuel's (2006) study uses data from several countries to view how one-to-one laptop initiatives were implemented. The author notes that a wide range of studies have shown that students use their laptop devices inside the school and at home for formal learning that is an extension of the school curriculum. The author states that students often use the laptop device to take notes, to complete homework assignments, for organizational purposes, to communicate with teachers and peers in regard to school work, and for researching topics on the Internet in relation to school work and curriculum. Furlong and Davies (2012) report that students often use their computer devices for more basic formal tasks as organizing their schoolwork, sharing and transporting their work, using "electronic recommendation systems" (e.g., Amazon), and learning support materials (e.g., Spark notes). Jewitt and Parashar (2011) establish that students enjoy researching online and taking tests and quizzes online due to the immediate feedback that they receive from the computer technology. The authors affirm that students also enjoy the privacy of receiving feedback on assignments without the social anxiety of being corrected or

instructed by the teacher while in front of their peers. Kent and Facer (2004) note an interesting concept of formal learning through computer technology when they observed students "acting as teachers" in a formal capacity at home to their parents. The authors use the example of the young girl teaching her father how to use PowerPoint to demonstrate how formal learning practices are being carried into the home.

In studying the UK's Home Access Program (HAP) from 2008 to 2010, Jewitt and Parashar (2011) noted that the ability for all students to have a computer device allowed for teachers to better understand their student's interests. Due to the "freedom" that the Internet allowed the students, students were able to pursue their own interests for classroom assignments—this allowed teachers to better know their student's individual interests and better guide their learning while in school. Jewitt and Parashar found that even when teachers criticized students for time spent on the Internet that was "unproductive," they recognized that students were more motivated to do schoolwork when they also had the ability to search at their leisure and "chat" on-online with friends.

Storz and Hoffman (2013) studied a one-to-one laptop program at a Midwestern urban middle school, utilizing the voices of eighth grade students and their teachers. The authors determined that students found that access to a digital device and the Internet at school and at home made their work much easier to do, and the students were also more productive. This is especially true when students have online access to school textbooks. Storz and Hoffman interviewed teachers who felt that when students completed homework using a computer device, they went "above and beyond" in the tasks. The teachers reported that student's knowledge and freedom on the Internet motivated them to provide more in-depth answers and higher quality work.

Sefton-Green (2006) reviewed policy and public debate in the realm of media culture and notes that much of research conducted on student learning has been done in the realm of formal learning. The author claims that as a society we do not tend to value learning that is not formal in nature and that we do not recognize learning to occur unless it can be "categorized with reference to frameworks of academic disciplines we recognize as 'knowledge'" (p. 6). Sefton-Green posits that the study of education can be quite politicized in nature. The author proclaims that informal learning practices are not often funded by the public; therefore, they do not receive the attention that they deserve. However, he states that there is a growing political interest in the realm of informal learning due to what he terms as the importance of the "knowledge economy." Sefton-Green places an emphasis not only on formal learning, but lifelong learning that must take place both formally and informally in order to compete economically in the changing global economy; he notes that even with this knowledge and sense of urgency that there is still a noticeable gap in resources toward this phenomenon when compared to other educational issues. Furthermore, the author reports that it can be quite difficult to observe informal learning as it often takes place "within the head" of the learner—and cannot be as easily observed as many formal learning activities.

Furlong and Davies (2012) conducted a large-scale mixed methods study in order to better understand the home environment as a context for learning. The authors reference the freer access that students have at home through the digital device and the Internet that allow them an extended and often unlimited amount of time and resources to learn informally. Storz and Hoffman (2013) report that students use the computer devices in a large part as a tool for communication; and Jewitt and Parashar (2011) found that much of this communication took place on social networking sites such as Facebook. The authors specify the importance of

communication in this realm as a means to maintain "social participation." Jewitt and Parashar state that the ability to communicate provides the informal learning necessary to "increase the student's personal confidence to be a part of a community." The authors note that there is such a large amount of social interaction that takes place online that for students not be a part of it and the informal skills that it provides, they would be unable to fully participate as informed members of the social group.

Candy (2004) studied information and communication technologies and the impact that information and communication technologies (ICT) has on learning. The author reports that various technologies are becoming so woven into our daily life and activities that the boundaries between these activities and online learning are becoming increasingly more blurred. The author states that this trend will continue to increase as new technologies come to be in our society and as the new generation of learner grows up surrounded by the ubiquity of ICT. Candy claims that there is such a close resemblance and combination between entertainment and many forms of education that this phenomenon might be "one of the defining convergences of our age."

For this purpose, attempts have been made to break down different types of student learning so that they may be better understood. However, it is important to note that the many varieties of student learning have been studied, and there have been numerous classifications of student learning throughout time. In 1982, Mocker and Spear studied adult learning and attempted to better understand the various kinds of learning that adults utilized as they gained more freedom and control over what they learned. The authors of the study were able to categorize learning into four different types, and for that reason the researcher is using their model through which to view student learning in this study.

Conceptual Framework

In their study, Mocker and Spear (1982) attempt to clarify the meaning of lifelong learning and the role of "control" in various types of learning that take place along this continuum. In their work they provide a model and matrix to identify four types of learning that makeup lifelong learning: formal learning, nonformal learning, informal learning, and self-directed learning (Figure 1).

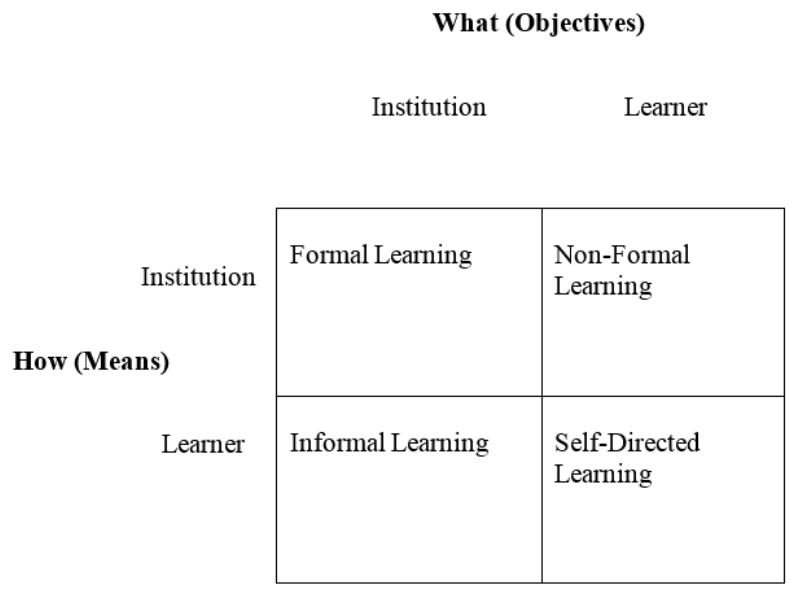

Figure 1. Lifelong learning matrix.

Mocker and Spear (1982) provide brief definitions of each type of learning, with "control" being the key concept that differentiates the four. Formal learning is identified by a total lack of control by the learners, where "learners have no control over the objectives or means of their learning" (p. 4). The authors state that this type of learning is primarily associated with formal schooling that takes place at the elementary level, secondary level, and university level. The authors do note that formal learning does not have to take place within a formal setting.

Even before the Internet was used for online education, many recognized that formal learning could and did take place outside of the formal school setting.

Mocker and Spear (1982) go on to provide a brief definition of nonformal learning by stating that in this style "learners control the objectives, but not the means" (p. 4). Here the authors note the first departure from the "control" of formal learning and describe a learning activity in which the learner has some decision-making powers. Here the authors state that "leaners make decisions on what is to be learned, but seek help on the how or means of the learning activity" (p. 6).

Mocker and Spear (1982) offer a brief definition of informal learning as a situation where "learners control the means but not the objectives" (p. 4). Here the authors report a further departure from the formal learning methods with more control shifting to the learner. In this scenario, while the institution maintains control over the goals of learning, the learner is provided autonomy in the means for achieving these goals.

Finally, Mocker and Spear (1982) present to us a brief definition of self-directed learning, or learning in which "learners control both the objectives and the means" (p. 4). They call this type of learning the "ultimate state of learner autonomy . . . [where] the learner exercises control over and major responsibility for choosing both the goals and the means of the learning" (p. 11). The authors once again use the concept of "control" to show the greatest departure and freedom from formal learning that is held by the institution.

The work of Mocker and Spear (1982) will be used in the following study as a lens to view the learning that takes place by students who are away from the traditional school setting and who are using their laptops provided to them via the school's one-to-one laptop initiative.

The four different learning styles outlined above will provide a lens for discussion and analysis as students provide their stories and describe their experiences.

Induction of technology into society. Proponents of technology integration argue that the growing induction of technology into our society and the need for access to this technology, as well as the skills to navigate this technology, are critical aspects to becoming a successful citizen in the 21st century. Mossberger et al. (2008) review and build upon prior research in the realm of the Internet and public policy. The authors state that they recognize the many benefits of Internet access, but are more concerned with how Internet access impact citizenship and opportunities. They make reference to digital citizenship and state that a "full citizen" in today's society must have access to digital devices and Internet connectivity on a daily basis. The authors claim that this access is a key aspect to economic opportunity, democratic participation, and communication. Other studies support the claims made by Mossberger et al. In the realm of consumerism, Seock and Norton (2008) and Mubin (2012) study the rapidly growing Internet use for online shopping and what that might mean for the way that corporations market to customers and the future of how consumers make purchasing decisions. Furthermore, research conducted by Beers (2006) views aspects of technology integration and how that affects democratic participation. The author discusses the rapid growth of individual online journalism in relation to democratic participation, encouraging individuals to "draw on independent media to spark conversations about justice issues and alternative visions of the good society of the future" (p. 125).

Education entities recognize technology as a key component of today's society that will be growing exponentially in the future; they are also aware that there is a gap in access to these resources that exists among their students (Warf, 2012). Educators are placing emphasis on the

students' ability to navigate this digital world in order to be successful citizens, and many are attempting to ensure that all students have access to digital resources by providing them through the educational system. In response to this phenomenon, one-to-one computing programs were developed in order to provide all students the access to digital devices and Internet connectivity, so that they may be better prepared for success in the digital world. This movement began in the 1980s in Australia and has expanded rapidly around the world, particularly in the United States and the United Kingdom.

The digital divide. In his paper on cyberspace and inequitable access to the Internet, Warf (2012) notes that even as digital devices becoming increasingly more affordable there is still a significant amount of citizens in our society who do not have adequate or reliable access to digital resources and Internet connectivity. Warf states that to many, often the poor, "cyberspace" is inaccessible—leaving these citizens "lacking the requisite technical skills, the income to acquire a personal computer at home, and jobs that provide reliable Internet access" (p. 1).

Warf (2012) described what is commonly referred to as the "digital divide." This term has been used broadly, but is viewed by Warf as a gap in access to both digital devices and Internet connectivity that exists between several sub-groups, mostly identified with economic disparity. The "divide" creates a barrier to digital equity; otherwise defined by Becker (2006) as "ensuring that every student, regardless of socioeconomic status, language, race, geography, physical restrictions, cultural background, gender . . . has equitable access to advanced technologies, communication and information resources, and the learning experiences they provide" (p. 4).

The U.S. Census Bureau (2013) revealed that 57% of households with an income less than $25,000 had no at-home access to computers or Internet. The same study noted that only 10% of households with an income exceeding $100,000 were without computer and Internet access. This trend continued when looking at factors of education. One fact was that 79% of urban households did not have access to a computer or Internet, and 21% of rural schools were completely without access. Mossberger et al. (2008) use previous research from the PEW Internet and American Life Project and the Pew Research Center and their surveys to argue the role of access to digital resources and the Internet to fully participate in today's society. The authors define the digital divide and/or digital exclusion (as noted above) and posit that without access to these resources, 27% of Americans (according to Pew research studies) are not sufficiently able to find work with higher wages, be as politically involved, and generally suffer the inability to participate in the "full citizenship" experiences that these resources provide. This research is highly relevant to my study in that in not only defines the parents of a large amount of our low-income students, but also exposes the disservice in educational opportunity if these resources are not provided to our students.

Origin of one-to-one laptop programs. In many ways the one-to-one laptop movement is founded in the works of educational technology visionary, Seymour Papert. Papert's work has led to a growth in educational technology and has inspired various laptop initiatives that attempt to get a computing device into the hands of all children. Examples of these efforts can be seen on scales that are as large as country-wide initiatives such as the HAP in the UK; to state-wide U.S. initiatives in Maine, Michigan, Texas, and Massachusetts; to city-wide initiatives in Melbourne, Australia; and district and school-wide programs throughout the world. The movement has even

inspired global efforts to provide all children with a laptop device through One Laptop Per Child (OLPC) program founded by Nicholas Negroponte (Negroponte, 1995).

Examples of these initiatives are seen around the globe with one of the first one-to-one laptop programs implemented in the late 1980s in Melbourne, Australia where students in Grades 5–12 were required to purchase a Toshiba laptop for schooling (Russell, Bebell, & Higgins, 2004). Small pockets of experimental implementation around the world have grown into massive efforts to provide laptops for all children of various countries—specifically children of school age in impoverished areas. In 2006, Nicholas Negroponte founded the non-profit organization OLPC and seeks to provide laptop access to children in the most impoverished geographical locations in the world. During 2008, Australia and United Kingdom launched nation-wide efforts to provide school-age children with laptop devices through the Digital Education Revolution project in Australia and the HAP in the United Kingdom. In the United States, state-wide initiatives have been implemented in Maine, Texas, New Hampshire and California; and, thousands of one-to-one laptop initiatives have been put into effect at the local district and building levels.

However, small and large programs alike have been challenged by the financial resources that it takes to support such programs. From local school to national efforts, many programs have faced the inability to sustain the programs financially (Ritzhaupt, Hohlfield, Barron, & Kemker, 2008). And it is the significant costs of these initiatives that draw critical reactions to their "value added" to the educational and learning experiences of their recipients (Hu, 2007).

To determine if these programs are effective, many studies have been conducted to measure and assess the impact that these programs have on the educational environment. These

studies have viewed the programs through various lenses, including: pedagogy, student behavior, student achievement, equitable access, and in-school and at-home use.

One-to-one laptop initiatives and teacher pedagogy. In efforts to determine the success of one-to-one laptop programs, multiple studies reviewed the impact of ubiquitous computing on pedagogy. Bebell and Kay (2010) studied the Berkshire Wireless Learning Initiative (BWLI) in Massachusetts. The BWLI was a pilot program that provided students with one-to-one laptop access; that authors conducted a pre and post study on the impacts of the computing program over the 3 years of the study. The authors reported that the majority of teachers involved in one-to-one laptop programs feel that the access to these digital resources made them "better teachers." The same study reported that only 10% of teachers claimed to not be as effective due to the use of laptops in the classroom. This information reflects the larger body of research in this area where there is an overall feeling that the access to digital resources that are provided in a one-to-one laptop program are welcomed by teachers and improve their ability to deliver curriculum to their students and enhance learning.

Dunleavy et al. (2007) used a qualitative study consisting of both formal and informal interviews with teachers to determine the teacher perceptions of one-to-one laptop programs. The authors noted that the 1:1 student to laptop ratio added value to pedagogy in five main ways: (a) increased ability to formally assess, (b) increased ability to individualize instruction and pacing, (c) increased ability to provide timely feedback, (d) increase in student interaction and collaboration, and (e) increase in student engagement.

Further studies noted that the implementation of the 1:1 initiative not only benefited students, but teachers reported feeling empowered to "create, enhance and customize" lesson plans and teaching materials. Holcomb stated that teachers report using laptops to research lesson

plans and further develop materials. They also report great improvement in the realm of communication with other colleagues and students (Bebell & Kay, 2010; Holcomb, 2009). Holcomb noted that "70% of teachers surveyed reported that the laptops helped them to more effectively meet their curriculum goals and individualize their curriculum to meet particular student needs" (p. 51).

Perhaps one of the more popular claims in support of the implementation of ubiquitous computing programs and pedagogy is the movement to a more student-centered approach to curriculum and instruction. Keengwe, Onchwari, and Onchwari (2009) noted the ability of technology integration, if done correctly, to shift the focus from the teacher to the student:

> Technology changes the roles of teachers and students: The traditional role of teacher as dispenser of information is challenged, and the teacher's new role is that of a guide—to challenge students' thinking and encourage reflection in the learning process. (p. 16)

In this learning model, the student is able to take a more progressive and constructivist approach to learning and understanding by using technology as a vehicle to make this shift and paradigm change for both the student and the teacher.

Dunleavy et al. (2007) note in their study that the availability of student laptops allowed the teachers to hold a brief larger-group instruction session, but quickly break the students out individually or in small groups so that they could work independently. Jewitt and Parashar's (2011) work with the HAP in the United Kingdom also claim the significant increase in student independent learning opportunities. The authors state that this independence led to more student flexibility and choice, which in turn led to a broader use of online resources and increased student motivation and engagement.

Proponents argue that a major benefit of one-to-one laptop programs and teacher pedagogy is that they allow students to have their own personal device that they can take home

with them. Jewitt and Parashar (2011) assert that the student's ability to take this device home—and use it as their own, provides students with a tool that extends their learning opportunity beyond the traditional school day and allows them to carry a significant information resource with them at all times. Dunleavy et al. (2007) recognize the significance of this aspect of the program to teacher pedagogy, in that one of the most frequent uses of the resources by teachers was to create online learning environments, including individual teacher and classroom websites. With student access to a laptop and Internet outside of the school environment, teachers are able to post assignments, give feedback, and even post videos and website links to further instruct students in difficult concepts. Swanson (2013) demonstrates the types of freedom that some teachers perceive the laptops provide students through the following quote: "I tell them, with this laptop, anything you have a desire to know about, you can go and seek that information on your own."

Advocates for one-to-one laptop technology and teacher pedagogy promote the impact that these resources have on student collaboration and the push toward a more student-centered and active learning classroom environment. Rockman and Walker (2000) noted that teachers involved in one-to-one laptop programs have a higher tendency to incorporate more student-led learning initiatives in their classrooms. Russell et al. (2004) states that not only are students more likely to participate in "hands-on" learning in a one-to-one classroom, but teachers are much more likely to place students into groups and encourage and require collaboration and peer conferencing; these same classrooms report less lecturing and whole-class instruction (Penuel, 2006; Russell et al., 2004; Swanson, 2013).

However, not all studies reported such positive responses from those interviewed. Dunleavy et al. (2007) found that many teachers believe classroom management to be more

difficult in the one-to-one classroom environment. Teachers reported that when students had access to the devices that they were more likely to play games, waste time 'surfing' and even visit pornographic websites. Swanson (2013) recognized that some teachers felt it more and more challenging to cooperate with 20 students who were each working on a different project.

Students also showed frustration with their teacher's move to more project-based learning. Some students felt that their teachers incorporated projects that were unnecessary and boring. And, some students even felt that less instruction was taking place and that the teachers used the presence of the device as an excuse to plan less and place more responsibility upon the students to teach themselves, even allowing other students to fail (Storz & Hoffman, 2013).

Garthwait and Weller (2005) studied two middle school math teachers in Maine to determine the role of the one-to-one laptop program in the creation and delivery of curriculum and instruction. The authors found that teacher's individual beliefs in technology played a significant role in how new technologies impacted pedagogy in their classroom. Teachers who were more willing to embrace the new technologies and allow students to experiment with the technology found more success with student learning. However, teachers who were not as eager or willing to adopt the one-to-one laptop programs used the devices less and allowed students less freedom when the devices were being used.

With several variables factoring in to the impact of laptop computing on teacher pedagogy, Warschauer (2008) notes that laptops will not make "bad schools good, but good schools better" (p. 35). Said differently, the addition of laptops to the classroom environment will not guarantee student motivation or engagement, nor will it guarantee a shift in pedagogy from teacher-centered to student-centered instruction. However, if the teacher is willing to

embrace the devices and allow the students freedom with the device, a strong shift in pedagogy can occur.

One-to-one laptop initiatives and student behavior. Several studies have sought to determine the impact that one-to-one laptop initiatives have had upon student behavior. Researchers have reported that the presence of laptop devices have been observed as having a significant impact on student behavior in both the positive and negative realms. One of the areas that show a significant and positive impact is that of attendance. Schools that have incorporated one-to-one laptop initiatives have also been found to decrease absenteeism (Lemke & Martin, 2003; Shapley, Sheehan, Maloney, & Caraikas-Walker, 2009). A study conducted in Maine in 2004 looked at the 7-year history of the laptop program and found that schools who chose to implement the laptop initiative saw a 7.7% increase in student attendance (Muir, Knezek, & Christensen, 2004).

Other positive impacts of laptop initiatives on student behavior involve student engagement and motivation. Lemke and Martin (2003) found that during Maine's first year of the laptop adoption program, there was a drop of 54% in student behavior letters sent home to parents. Gulek and Demeritas (2005) determined that students who took part in instruction that included laptops were more likely to be engaged in the learning activity than students who were not using the devices. And, a study conducted in Michigan by Lowther, Ross, Strahl, Inan, and Pollard (2005) specified that 60% of students surveyed reported that they had an increase in interest to learn when participating in a laptop program.

It is also important to note that Dunleavy et al. (2007) found that students affirmed that the possession of the laptop allowed them to have more privacy in the learning environment. Due to this privacy, students expressed the ability to ask more questions without embarrassment in

front of their classmates. Furthermore, Silvernail and Lane (2004) discovered that 70% of students who were using a laptop device reported that they were able to better organize themselves for educational purposes due to the device. These students mentioned that the benefits to this organization were the ability to complete homework more efficiently and with higher quality.

In contrast, not all feedback was positive when it came to student behavior and the use of laptop devices. Dunleavy et al. (2007) stated that student access to online materials during instructional time provided the challenges of monitoring students researching of inappropriate materials, such as gaming and pornography, and managing student misuse of the device and Internet access by wasting time conducting "ineffective" searches. Hu (2007) reported the same concerns from parents and noted that student misuse of laptops has a damaging effect on parent and teacher support of such initiatives. Hu referenced such negative student behaviors as cheating on tests and hacking into school and local business computers. The 2007 study also reports a general concern for the ability of the laptop devices to "fit in" to teachers' lesson plans and concern shared by teachers, parents and the community in regard to the overall costs of the initiatives.

One-to-one laptop initiatives and student academic achievement. Perhaps the most controversial topic in the short history of one-to-one laptop initiatives is whether or not the ability of such programs can have a positive effect on student learning and academic achievement. Many studies have been conducted on this topic and the results have been inconsistent. While several studies have reported success, including Muir et al. (2004) who noted that students involved in a one-to-one laptop initiative in Maine increased student achievement in math and writing, there have been several documented failures. Holcomb (2009) contends that

after a 4-year study of one-to-one laptop schools in Texas, there was no statistically significant evidence that these programs had any effect on student achievement in regard to the Texas Assessment of Knowledge and Skills. Furthermore, Warschauer (2008) followed the progress of 10 schools in California and Maine from 2003 to 2005 and found no research-based evidence that one-to-one laptop programs had any impact on student achievement in relation to state test scores.

Penuel (2006) asserted that students involved in a one-to-one laptop program showed significant improvements in technology use and technology literacy, but results in the realm of research-based evidence that the program improved student writing was "somewhat less strong." And, Russell et al. (2004) reported that students in classrooms with one-to-one technology were six times more likely to be observed writing text with the computer than with pencil and paper. In reference to academic achievement, the authors note that teacher interviews revealed that students with laptops were more likely to write more and with higher quality than when they wrote with pencil and paper. Jewitt and Parashar (2011) reported that students who did not usually attempt to do homework were more likely to do so when working with their laptop computer. In this study, students mentioned that having access to the laptop device allowed them the flexibility to complete homework at their own pace, ask teachers questions about homework, and communicate with classmates about homework. Furthermore, as a result of this the teachers affirmed that these students saw an improvement in their grades and GPA. Bebell and Kay (2010) found that students with laptops were more willing to write second drafts of writing work and were able to grasp more difficult and complex concepts; they further reported that students using the computer devices submitted "better looking products" when it came to homework and papers.

Additional studies proved a strong connection between student use of laptop devices and writing skills. Holcomb (2009) conducted a collective review on one-to-one laptop initiatives and reported that several one-to-one schools across the country had seen an improvement in student writing due to the amount of time that students were spending using their device. Holcomb stated that students with laptop devices were also more likely to edit and reflect on their written work. The same study by Holcomb viewed two comparison groups in Maine, one that had access to laptop computers and one that did not, and found an effect size of .64 in reference to the relationship of having access to the laptop devices and the student writing score on the Maine Educational Assessment (MEA). Holcomb remarked that this information reflected that the average score of those who took the test and had access to laptop devices scored higher than 75% of those students who did not have access to computing devices. An earlier study completed by Jeroski (2003) viewed the "Wireless Writing Project" in British Columbia and reported an increase of 22% of students who met the writing performance standards over the course of 1 year. Suhr, Hernandez, Grimes, and Warschauer (2010) reported gains in both writing and literacy skills when their study viewed students at a younger age compared to students in the fourth grade who were transitioning between "learning to read and reading to learn."

Some studies were able to show an impact of one-to-one laptop initiatives on content areas outside of writing. Stephenson (1998) published a study that was conducted in South Carolina; he was able to conduct a longitudinal study over the course of 2 years with seventh-grade students who were participating in a one-to-one laptop program and who "significantly" scored higher in the state math test than peer groups who did not have access to the program. Jewitt and Parashar (2011) saw improvements in student math and science scores in correlation

with access to laptop devices, and Holcomb (2009) reported increased scores on the math portion of the MEA, even though they were not as significant as those found in the writing portion that same year. Additionally, two studies reported that having access to one-to-one laptop technology can improve student performance in science at the secondary level (Berry & Wintle, 2009; Siegle & Foster, 2000).

However, despite the many stories of success through these laptop initiatives, Hu (2007) states that many schools are dropping these initiatives because there is not enough research to show the positive impacts of the programs in light of the high cost to sustain the projects. And, it is due to the lack of overwhelming research-based evidence of one-to-one laptop programs within the school that we turn to the impact of home use of computers and how having these resources away from the traditional school environment can benefit students in the learning process.

Student home computer use. T. Downes (1999) conducted one of the first studies which primarily focused upon the usage of computers by young children. He reported that studies of home computer usage have been done since the 1980s, but that these previous studies have been primarily focused upon adults and not children. However, student home computer use has become a much more researched topic as more studies report the growing amount of time students spend on their digital devices and Internet at home (Eynon & Malmberg, 2011). One-to-one laptop initiatives lend themselves well to this research as students in a complete 1:1 environment are able to take their devices with them when they leave the traditional school environment. Yuen and Park (2012) state that students who have access to computer devices in their home make gains in "academic achievement, new digital skills, new knowledge, and . . . learning during [the] computer game playing process" (p. 1).

Furlong and Davies (2012) make the argument that to truly attempt to understand how the students of today learn, we can no longer restrict ourselves to the traditional school environment. Furlong and Davies claim that learning is becoming "unbundled" in the sense that schools are no longer the only resource for academic learning. The authors state that we must look to how students are using technology and accessing the Internet when they are at home to fully understand how the student of today is learning. Kent and Facer (2004) maintain that laptop devices from one-to-one laptop initiatives have played a key role in extending the traditional school environment into the home and have provided students the ability to communicate with classmates and teachers outside of school. Kent and Facer assert that this phenomenon has led to the increased "permeability of the boundaries between home and school."

In China, Yuen and Park (2012) conducted a study on the difference between home use of computers and the usage of computers at school. The authors report that student perceptions toward home Internet use and school Internet use are significantly different. Students from their study had the perception that using the Internet at home allowed for "freer exploration and experimentation" in comparison to their use of the Internet in school, which they reported "suffered from technical limitations, inaccessibility and the constraints of school policy."

Furthermore, studies have strongly linked student access to computer devices in school to their use of computer devices at home (Penuel, 2006). Student uses of computer devices often mirrored themselves inside of school and outside of school. Those students who had access to digital devices at home would use the computers at school more frequently than those who did not have access to these resources away from the school environment (Kent & Facer, 2004; Russell et al., 2004). Kent and Facer (2004) also found that students mimicked the activities performed at home on school devices.

Studies have found a correlation between at-home use of computer devices and student academic achievement. Roschelle et al. (2000) found that home access to computers can provide great benefits in the realms of expanding and extending the learning environment and increasing the personalization of learning. Kerawalla and Crook (2002) report an impact on student motivation and showed an increase on student time spent on learning activities when they had access to a computer device at home. Espinosa, Laffey, Whittaker, and Sheng (2006) reported that there was a direct correlation to student achievement in reading and math, with access to technology in the home environment. The same study further reports a direct correlation between technology in the home and graduation rates. Jewitt and Parashar (2011) report that the use of computers at home improved the quantity of homework completed by students, the quality in which the homework was completed, and student homework scores went up as a result of those factors.

Having a computer device in the home impacts more than just the student; parents and other family members living in the household also see benefits. Jewitt and Parashar (2011) studied the HAP in the United Kingdom and found that parents felt much more involved in their children's learning process when there was a computer device in the home. Parents reported that not only did it increase communication between them and their children, but they were also able to communicate with the school more frequently as well. Jewitt and Parashar also found that more than half of the parents in the study reported using the student's device and were able to stay in touch with family members and benefit their own "life and work" opportunities.

Gender and computer use. For the purposes of this study, it is imperative that we review literature in regard to gender and computer use. There is significant research stating that male and females use digital devices differently. These studies cover a broad range of gender

experiences from preschool to adult learning programs, and address major societal issues that may attribute to gaps and differences in the use of technology by males and females.

A study conducted by McNair, Kirova-Petrova, and Bhargava (2001) viewed "gender bias" as a major variable in male and female computer use. The study was initiated in order to provide support to female students in the realm of computer technology. The authors report that our society contains multiple sources of gender bias in regard to computer use and that each of these have an added impact on young children as they are introduced to them. McNair et al. stated that

> advertisements on television and in magazines overwhelmingly depict men and boys as computer users. . . . They are engaged in professional, active roles and, in contrast, females are looking pretty or provocative posing beside a computer. . . . Boys are portrayed as users while girls are more often "decoration." (p. 51)

The authors go on to note that the majority of computer software in existence is aimed at "boys" as it pertains largely to gaming and is "dominated" by male protagonists. The authors note that "girls use computers less than boys in and outside of school, and girls are more likely than boys to report that their introduction to computers occurred at school rather than at home" (p. 52).

Zevenbergen and Logan (2008) conducted a survey study in Australia that focused on the computer usage of children of 4–5 years of age. The study indicates that many students who enter the traditional educational setting have already had a tremendous amount of exposure to computers in their early childhood. Furthermore, the study notes gender differences in that boys used the computers more frequently than girls—a finding in which the authors attribute to the boys' enjoyment of gaming and "general use" of the Internet.

The authors note that gender differences can be seen as early as ages four to five in computer use and skill development, and they also note that males have more access at an earlier age than females. The authors state that educators and policy makers must acknowledge not only

the differences in male to female access and usage, but to the general computer skills of students as they now enter the educational setting because to provide a "quality learning environment" for these digital natives will look differently than it did for previous generations.

Other studies have shown very little difference in gender access and use in regard to digital technologies and the Internet. Wasserman and Richmond-Abbott (2005) used the General Social Survey to study gender use and access by considering a broad range of variables, including: socioeconomic status, social variables, geographic variables, and ethnic variables. The authors organize their findings in four categories, or "factors": entertainment and personal interaction, government and politics, art and education, and hobbies and practical information. Wasserman and Richmond-Abbott state that gender plays a "significant" role in only the factors of "entertainment and personal interaction" and "hobbies and practical information," stating that "women [are] less likely to use the web for entertainment and personal interaction, and more likely to us it for hobbies and practical matters" (p. 264).

Summary and Implications

The purpose of this literature review is to introduce the reader to the conceptual lens of the study, as well as provide a foundational understanding of the key issues involved in the study. This literature was gathered by using various "search engines" and database software, including: Google Scholar, JSTOR, and EBSCO. Search terms included key concepts related to the study and a myriad of combinations of key vocabulary related to the study. The result of which provides a look into the vastly growing and omnipresent fusion of digital technology into our society while paradoxically still leaving a gap or divide in access.

The literature reveals that several countries, states, districts and individual schools are attempting to prepare students for a new learning environment by providing them with computer

technology in the form of "one-to-one" laptop programs, or ubiquitous computer programs. The literature also reveals that technology is having a significant impact on what "school" looks like for students in the 21st century. The literature shows a change in student behaviors, a change in teacher pedagogy, and a change in the way that students fundamentally learn.

The literature shows a gap when it comes to viewing how students take this technology home with them. The review does contain studies of at-home computer use because these are focused upon the adult learner in the home setting and less upon students in all areas outside of the traditional school environment. It is also important to include literature that covers the role that gender plays in the use of technology. While there are some profound differences in how different genders use the devices, there are more similarities than differences as digital technology grows and evolves along with a new generation of users. Fundamentally, the new generation of students use digital technology more equally, as both males and females have more access to these devices and live in a culture that promotes and celebrates the use of technology by both genders.

Based upon this review of literature and the gaps that were revealed, this study is designed to take a closer look at how students use their computer devices when they are away from school. Furthermore, the study is designed to view this use through the lens of the various types of learning that take place during the multitude of activities that the students participate in.

Chapter 3: Methodology

The purpose of this study is to provide a better understanding of how students utilize their computing devices to form learning; specifically, when they are away from the traditional school environment. The chosen methodology for this inquiry is the use of an interpretive paradigm and the study follows the traditional emergent design of qualitative research.

Throughout this chapter, the researcher provides: a description of the setting of the study, the process of participant selection, a description of the data collection instrument, a positionality statement, a description of the data collection procedures, a description of the data analysis process, a description of the data tracking and coding process, the trustworthiness of the study, and the study's limitations.

Research Question

How do students involved in one-to-one laptop programs utilize computing devices to form learning in out-of-school environments?

Interpretivist Paradigm

An interpretive paradigm is used for this case study of student out-of-school use of computing devices. Orlikowski and Baroudi (1991) state that interpretive studies "assume that people create and associate their own subjective and intersubjective meanings as they interact with the world around them," and that as researchers conducting an interpretive study, we are attempting to "understand phenomena through accessing the meanings that participants assign to them" (p. 5).

In viewing interpretive methods, Walsham (1993) discusses the nature of reality and places an emphasis on the role of "social construction" in relation to the participants of the study as well as the researcher. Walsham states that there is no objective reality to be discovered, but

rather a reality that is both constructed by the participants and their world, and then interpreted and constructed by the researcher. Geertz (1973) described this process: "What we call our data are really our own constructions of other people's constructions of what they and their compatriots are up to" (p. 9).

In this study, the reality examined is that of the participant's use of computer devices in out-of-school environments. Specifically, how students that are involved in one-to-one laptop initiatives use their laptop devices and other devices at their disposal to engage in various types of learning.

Research Method

The study follows the "emergent" design tradition of qualitative research. As such, revisions and adaptations were made throughout the process in order to provide the "greatest potential for discovery" (Bogdan & Biklen, 1982; Lincoln & Guba, 1985). Connelly and Clandinin (1990) make reference to students as storytelling "organisms" and the researchers who study these narratives as seeking to understand the "ways that humans experience the world" (p. 2). Lincoln (1995) notes that the student perspective has long been absent from educational research and school reform. For this purpose, the research has incorporated the two by interviewing students to better understand how they use laptop devices outside of the traditional school environment for the purposes of constructing learning. Crotty (1998) states that

> it is the view that all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted with an essentially social context. (p. 42)

Through this study, it is the researcher's goal to better understand how students construct meaning and knowledge with their digital world outside of the school environment.

Setting

The study takes place at Hadley High School, a public high school located in the Harrisonville community, on the suburban fringe of a large Midwestern city. The school has an approximate enrollment of 1,350 students, 320 of whom are in their senior year. The school serves the students of Harrisonville from Grades 9–12.

Hadley High School was first chosen because of its involvement in a one-to-one laptop program that issues a laptop device to each student. Secondly, the school was chosen because of the researcher's position as an administrator within the school corporation. As the principal of the middle school in the district, the researcher has consistent access to students and a familiarity with how the one-to-one program has been implemented and operates.

Harrisonville is a community of approximately 9,500 people. It is a suburban community that is located approximately 14 miles southwest of a large Midwestern city. Roughly 17.5% of adults in the community have less than a high school diploma or its equivalent. Forty-two percent of the pupils in the Harrisonville School District are eligible for free/reduced priced meals; and the school district is predominantly homogenous in race/ethnicity, with 93.5% of the pupils identifying as "White." The 2014–2015 district enrollment was five thousand; the school district consists of five elementary schools (Grades K–6), one middle school (Grades 7–8), and one high school (Grades 9–12).

A survey conducted in 2010 revealed that almost 35% of the students in Hadley High School did not have consistent access to a digital device once they left the school environment. The survey was issued as part of a fact-finding initiative in regard to the potential one-to-one laptop program and resulted as the impetus for implementing the one-to-one laptop initiative.

Participant Selection

Participants for this study were identified and selected based on their grade level, age, use of their device, and articulation of their use of their device. The purpose for these selection criteria is to provide the richest information possible that will inform how students use their devices away from school for various forms of learning.

The initial selection process identified all students in their senior year at the high school who are 18 years of age. These students were involved in the one-to-one laptop initiative for all 4 years of their high school experience and were of legal age to participate in the survey as adults. The former criterion of the selection process provided students who have been using the laptop devices for several years and who were highly familiar and experienced in using the laptop devices. The latter selection criterion provided students who are adults and can participate in the survey as such. This selection criterion was chosen to allow students to volunteer for the study on their own and to provide mature students who were able to articulate their perceptions of using the device to construct learning and meaning.

Participant Descriptions

Using the selection criteria above, 12 students were chosen to participate in the study (6 males and 6 females). The following are brief descriptions of the participants based upon the information provided during the interview process.

Males. Descriptions of the male participants follow.

Ryland. Ryland is a senior who has attended Harrisonville Schools for all but 1 year of his academic career. He describes himself as being "quiet" and a "hard worker." Ryland spent a lot of time discussing his love for gaming, stating that he spends 2–3 hours per day playing various games, mostly by himself at his house. However, despite his enjoyment of gaming,

Ryland says that ubiquitous access to technology is not critical for him by expressing that he does not find it necessary to have access to technology and the Internet at all times. Ryland also enjoys playing music and is a member of the school's orchestra program as a violinist.

Brendan. Brendan is a senior at Hadley High School and has attended the school corporation since his second-grade year. Brendan describes himself as "hardworking" and as having a lot of "discipline." Brendan is not particularly happy with the school's laptop program, stating that the devices are "outdated" and "flawed." Brendan has access to multiple digital devices when he is away from school and states that technology plays a significant role in his life. He remarks that school is often not very challenging for him and that often he is bored. Brendan is also involved in the school orchestra as a percussionist and plays the guitar and banjo when he is at home. Brendan places a large emphasis on education and plans to attend a private school for college. Brendan also golfs and is very active athletically. Brendan expressed concerns and fears that too much technology will lead to laziness in the next generation.

Parker. Parker has been attending Harrisonville Schools since his second-grade year. Parker defines himself as a very "average" student and states that he probably has to work a little bit harder than other students to get "good" grades. Parker claimed that his teachers often have to remind him to stay focused on his work. He does not take college preparatory classes, and he does not plan on attending a 4-year college. While Parker enjoys gaming, he finds little value in social media and does not find ubiquitous access to technology as a necessary component of his life.

Josh. Josh has attended Harrisonville Schools for his entire academic career. He describes himself as an athlete, who loves to play soccer. Josh is heavily involved in the school's "Champions of Character" group, which is a program that is meant to reward and celebrate

positive student actions and a caring culture. Josh says that he works hard as a student and that he has an "A" average. Josh takes a great amount of pride in being "honest" and treating others as he would like to be treated. He also views technology as an essential part of his life and spends several hours per week gaming and on social media.

Ronan. Ronan has been enrolled in Harrisonville Schools for his entire academic career. Ronan describes himself as "aloof" and that he is a "ghost" to everyone except for his close friends. He claims to have a custom built laptop that was given to him by his neighbor over 10 years ago. Ronan says that he updates the laptop himself as new technologies and software become available. Ronan also spends a great amount of time gaming; however, not in the traditional sense. Ronan does not own a gaming console, but rather uses sophisticated computer gaming software to compete in gaming tournaments around the world. Through this process, Ronan claims that he has made many friends from different countries and cultures, and has experienced a "broader world" than his local Harrisonville community can offer.

Luke. Luke has attended Harrisonville Schools since he was in kindergarten and describes himself as a "good" student who is "smart" and "personable." He describes coming from a home that is rich in technology, stating that he has access to his school-issued laptop, along with his own personal laptop, tablet, smart phone, and desktop computer in his house. Luke has a passion for jazz music and is a member of the school's marching band. He reports using social media frequently and also enjoys gaming.

Females. Descriptions of the female participants follow.

Maggie. Maggie is a senior at Hadley High School and participates in three sports. She describes herself as a "good" student and a "hard worker." Maggie plans on attending college next year on an athletic scholarship. She has good sense of humor and referenced the first laptops

that the school issued as "crap-tops." She states that she often uses her access to technology to look up new workout routines, dietary information, and to shop. Maggie has a passion for fashion design and interior decorating; she uses her digital access to view various projects and get ideas on how to decorate her dorm room and design hair.

Carissa. Carissa has been attending Harrisonville Schools her since her seventh-grade year and loves to sing and dance. She is a member of the school's show choir competition team and she describes herself as a good student, even though she does not do well on tests. Carissa states that she spends a lot of time utilizing her technology devices to listen to music and to view musical performances on video. Carissa says that she is "bad" at gaming, but loves to use her Nintendo Wii. While she uses technology a significant amount, Carissa does mention that she is worried about the stresses that "24/7" access brings.

Melinda. Melinda has always attended Harrisonville Schools and is involved at school as a cheerleader and participates in the "Best Buddies" program. Melinda describes herself as a "good" student who is very active in her community. She has been accepted into a large university nearby where she will be studying Communications next year. Melinda spends a lot of time using social media to communicate with her family and friends; however, she states that her personal preference is to use textbooks, which she can "hold and highlight."

Elizabeth. Elizabeth has been attending the Harrisonville District Schools since her second-grade year. She is involved in show choir and works part time with the city zoo. Elizabeth describes herself as a "passionate" student who loves to learn. She also describes herself as a "un-techie teenager" who does not use technology devices very often, and is a "big fan of pencil and paper." Elizabeth does use her technology devices to learn show choir

performances and to critique her own recorded performances. She dreams of designing animal habitats for zoos that allow for a more "real" experience for the animals.

Debra. Debra has been a part of the school district for 10 years and describes herself as a "responsible" student who gets her work done on time. Debra states that she is an "old-school gamer," using early devices such as the Nintendo 64 and Play Station 2. She enjoys using her school-issued laptop because if she does not have access to the Internet, she can still work on her device and then it will automatically upload her work the next time that the device has Internet connectivity. Debra spent a significant amount time discussing how she uses alternative educational websites to get help for her homework. Specifically, Debra stated that she often watches "how to" videos on YouTube and that she frequently accesses vloggers to learn about other cities and cultures.

Josephine. Josephine has attended Harrisonville Schools her whole life and describes herself as a "hard working student" who may not "build a rocket ship, but will try to." Josephine says that she often asks a lot of questions and that her teachers may find that annoying. She commented that due to academic struggles, she has to take credit recovery classes in order to graduate on time. She claims that the school's one-to-one laptop program helps her to do that, since she can take online credit recovery courses after her traditional school day. Josephine utilizes social media to communicate with her brother and nieces and nephews who live overseas. Josephine likes photography and utilizes her access to technology to store and edit pictures that she has taken, as well as make collages and slideshows for her family and friends.

Data Collection Instrument

The primary instrument for the collection of data was the researcher. The researcher used the work of Merton and Kendall (1946) to guide and conduct focused interviews that centered on

the "subjective experiences of persons exposed to the pre-analyzed situation" (p. 541); the "situation" being that of the shared experience as leaners in a one-to-one laptop educational environment. The initial method of data collection took place via a student questionnaire survey that informed the researcher of subjects to include in the interview portion of the study.

Data was collected for the study in the form of a survey and subsequent interviews. The survey was created and delivered through the online survey software of "Qualtrics." The data gathered from the survey was used to identify the habits of computer use among high school seniors at the site of study. Based upon the data from the survey, students were selected to participate in a 30- to 45-minute standardized open-ended interview. The number of students interviewed for the study was determined by the number of students that were required to reach "saturation" of data. Initially, 12 students were asked to participate in the interviews, 6 males and 6 females, and reasonable "saturation" was reached within this number.

Positionality Statement

As the researcher and the primary data collection instrument for this study, I find it important to present background information in regard to my personal experiences with technology (or lack thereof) that provided the impetus and passion for this topic of study. This information comes from two distinct areas, one being my professional life as a principal, and the other being my personal life.

Being the principal of a middle school that was the first building in the district to implement a one-to-one laptop program, I faced many challenges. I faced the frustration of many of my staff members whom felt unprepared to implement one-to-one technology into their curriculum and instruction; either they felt uncomfortable with using technology on a daily level, felt unprepared to convert or adapt their curriculum and instruction to an e-learning environment,

or they were philosophically opposed to providing our students with devices that could provide distraction from their teaching.

Furthermore, I faced criticism from many parents and community members whom felt that the increase in the textbook rental fee was inappropriate, and that the district was "wasting money" with the program—after all, many of them stated that they had graduated without ubiquitous access to computing devices and they received an excellent education.

The combination of staff frustration and community frustration, as well as the expectation from my school district leaders to successfully implement the program, led me to seek information on computing initiatives in an attempt to better understand their benefits and detriments. I must be forthcoming and state that before I began the study I was supportive of technology integration initiatives. Not only had I witnessed the advantages that it provided to students whom already had computing devices, but my personal experience with technology access and how it changed my personal and educational experience provided me with a fundamental belief in the importance of technology access and integration for all students.

Growing up in a small rural town in the 1990s, I had little access to technology at home and at school. To be fair, at this time most people that I knew did not have rich access to technology; however, I was fortunate enough to have grandparents who valued education and the role that technology would play in our lives as students and professionals. It was my Grandma and Grandpa Allen who purchased our first computer for our house when I was in high school—and it was my Grandma and Grandpa Allen who bought me my first personal computer when I went to college. With these tools I was able to have access to a broader range of information and I was able to access this information quickly and efficiently. It is important to say that I was not a "good student" in high school or my earlier years in college. In fact, I attribute my access to

technology as a critical component to my academic survival, not excellence. However, this technology played a critical role in my education as I was able to not only conduct research and complete assignments from my home and apartment, but I was also able to more efficiently search and discover my own personal interests. This access to technology led me to discover my love of reading and writing—which led to choosing English Literature as my undergraduate major. I did this at a time when I was a collegiate athlete and along with my peers and teammates, I made few trips to the library—due to time constraints of being heavily involved in athletics, and a culture that did not place a high value on making trips to the library. Nevertheless, I was able to search databases and discover information that fueled my love for learning and has led to where I am now as an educator. It is not a far stretch to say that access to technology did not only aide my academic success, but it helped me to discover who I am.

Data Collection Procedures

All students that met the above criteria were asked to take a brief questionnaire survey that assessed how often the students used their laptop devices and to what extent. The survey was created using online survey software from "Qualtrics" and was issued electronically through student e-mail during school hours. Students at this high school have a prep period built into their daily schedule for independent study and were asked to volunteer to take the survey during this time; 65 students completed the survey.

Questions from the survey gauged how frequently students used the provided laptop device outside of the traditional school day and environment. The traditional school day is defined as Monday through Friday, from the time of 7:15 A.M. until 2:35 P.M. The traditional environment is described as the physical "brick and mortar" campus of the high school. The questions were aimed at discovering the length of time that students spend using their devices

and the various activities that they use their devices for. Time spans for daily and weekly uses were assessed. For example, students were asked if they use their devices outside of the traditional school environment for 0–1 hours per day, 1–3 hours per day, or 3–5 hours per day. Students were also asked similar questions for weekend days as behaviors may change when more time is available when school is not in session.

Secondly, students were asked to identify the various activities that they use the computer device for. The survey was designed to provide students the opportunity to identify several categories of computer use including: homework, "surfing" the Web, communicating with friends, gaming, researching, social media, reading, and the opportunity to identify "other" uses through a short answer response.

Based on these responses, 12 students were selected to participate in a 30- to 45-minute open-ended interview. The 12 students selected to participate in the interview were first chosen based upon computer usage data consisting of the amount of time that they reported using the computer device away from school and for the range of activities were to be reported using the device. Students who use the device for longer periods of time and students who use the devices for a more broad range of activities will be selected to participate in the interview in hopes of gather more rich data and information from the interview process. Secondly, the participants were selected based upon gender (six males and six females). With a review of relevant research showing significant differences in how males and females utilize computer access, an even sampling of both were to be provided.

Once the 12 students were identified to participate in the extended interview process, each student was asked to volunteer for the interview activity. Upon agreement to proceed in the interview process, appointments were scheduled to conduct the extended interviews. Extended

interviews were conducted on the school campus; the high school's virtual learning center provided an accessible location that was familiar to the students. This location allowed for a comfortable and quiet environment that was conducive to the interview process. The interviews were taped by an audio recorder so that the researcher was able to be more engaged with each participant throughout the individual interviews.

Data Analysis Procedures

LeCompte and Schensul (1999) discuss taking large amounts of data from research and breaking it down into manageable information that can be used to explain what the researcher has studied. The initial data analysis for this study came from the questionnaire survey that was issued in January 2015. These surveys were first broken down by the amount of time that students reported spending on their laptop devices outside of the school environment. Students who reported spending the most time using their device were then analyzed again for the various ways in which they reported using the devices, with those who reported the most diverse usage being selected to continue in the process. After this analysis, a group of 12 (6 females and 6 males) were selected to participate in a 30- to 45-minute standardized open-ended interview.

Tracking Data and the Coding Process

Data analysis first took place in regard to the survey issued to all participants. The researcher used survey software from the "Qualtrics" program to provide the ability to gather information efficiently and "drill down" in regard to data collected from the survey and then "cross tabulate" to provide various combinations of data that was sought out by the researcher. Reports were generated in regard to participant gender, as well as how many hours per week the participant spent using a computer device outside of the school day. Reports were also generated in regard to participant gender and the reported activities that the computer devices were used.

Finally, the researcher analyzed the reports to determine matches between six male and six female participants who stated using their digital devices averaging more than 2 hours per day and for a broad range of activities identified in the survey. Table 1 provides a view of the amount of time that the participants spent using computing devices during an average week.

Table 1

Outside of the School Day (7:50 A.M.–2:34 P.M.), How Many Hours per Week Do You Spend Using a Digital Device?

	Answer	No.	%
1	0–7 hours (averaging 1 hour or less per day)	5	7.69
2	7–14 hours (averaging 1–2 hours per day)	16	24.62
3	14–21 hours (averaging 2–3 hours per day)	25	38.46
4	More than 21 hours (averaging more than 3 hours per day)	19	29.23
	Total	65	100.00

Twenty-five females reported using their computer devices averaging more than 2 hours per day, and 19 males reported the same. Of these participants, each of their surveys were viewed and analyzed for the amount of activities that the computer devices were utilized. Of the 25 females that reported using their devices averaging more than 2 hours per week, all reported using their devices for more than five different activities when they were away from school. Of the 19 males that reported using their computer devices averaging more than 2 hours per week, all reported using their devices for more than five different activities when they were away from the school environment. The researcher determined that both the amount of time spent using the devices and the number of activities that the devices were used for, were appropriate and sufficient for the study. The 44 participants, 25 females and 19 males, were then contacted and offered the opportunity to participate in the interview process. With only 12 initial appointments available, the first six males and the first six females to be scheduled were interviewed.

During the study, data was tracked by using a "matrix" system that provides an analysis of each participant's interview. Each salient piece of data is provided a "box" in the matrix and is coded into major themes and sub-themes. Table 2 provides an example of data that has been coded into broad themes for the study, and Table 3 demonstrates how each individual quote was analyzed for theme, subtheme, and learning theory correlation.

Data was then divided between male and female participants and analyzed for significant differences between the genders; during this process, each piece of data was re-evaluated and placed under more accurate themes and sub-themes when appropriate. The final result of the data is a color-coded matrix based upon gender, themes and sub-themes, and learning theory correlation, which is shown in Figure 2.

Table 2
Interview Data Coding Matrix by Theme (Condensed Sample)

Access	Digital citizenship	Formal learning	Self-directed learning	Entertainment
I feel like since I have access to it, I use it a lot. If I didn't, there will probably be a lot of times where I would feel like, I'm not up to par with like the rest of the class.	Technology's pretty much changing all over the world. . . . If you have no access to it, you're just going to be lacking there with communication and being able to be productive.	Yes, actually right now we are doing a project that has to do with the stock market, and we virtually pretend buying stocks and following those stocks throughout the course of a four-week period.	I pretty much go on Twitter or Facebook. Whenever there's an interesting link, I'll click it. Then learn more about it if it's like super interesting, so a lot of weird facts, I know.	typically I use Twitter the most. . . . Sometimes I will find myself a load of free time, and I will just go through my basic feed or whatever they call it, just people putting stuff on and read through just for entertainment purposes.

Trustworthiness. Trustworthiness, in regard to the data collected for this study, was viewed through the lens of Guba (1981). Guba acknowledges the clear distinction between "rationalistic" inquiry and "naturalistic" inquiry and reviews methods from both paradigms that are used to conduct research that demonstrate "Truth Value, Applicability, Consistency, and Neutrality." For the purposes of this study, the naturalistic paradigm was used; as the researcher, I ascribe to the holdings of the naturalistic paradigm that claim: "there are multiple realities . . . inquiry will diverge rather than converge as more and more is known, and that all 'parts' of reality are interrelated so that the study of any one part necessarily influences all other parts" (p. 77).

Table 3

Interview Analysis Matrix Sample

Participant	Quote	Major theme	Subtheme	Learning theory correlation	Researcher's notes
Melinda	My Big Campus is basically a way for students to turn in assignments online. You can login to your account, see what schoolwork you have, and submit assignments online.	Access	Extended learning opportunities through extended access	More typically aligned to learning associated with the behaviorist and cognitive theories as they are more easily submitted and communicated through the LMS	Extended learning opportunities through extended access Single source to locate information—accessible from any location with Wi-Fi

Guba (1981) breaks down trustworthiness into four categories that must be addressed: truth value, applicability, consistency, and neutrality and provide alternate terms for both the naturalistic and rationalistic paradigmatic approaches. The terms ascribed to the naturalistic

paradigm are as follows: Truth Value = Credibility, Applicability = Transferability, Consistency = Dependability, and Neutrality = Confirmability. These terms and definitions were used as guidelines to address various aspects of "trustworthiness" in the study.

Credibility. Guba (1981) states that naturalistic inquiry seeks to find truth value and credibility through verification of the findings with the sources from which the information was obtained. He offers various methods that can be used to increase credibility, including: prolonged engagement, persistent observation, peer debriefing, triangulation, member checks, and establishing structural corroboration or coherence.

The method of establishing structural corroboration was used in this study, which tested all data and the interpretation of that data against each other in order to ensure that there were no significant conflicts and that the overall report from the data showed coherence. Guba (1981) notes that with naturalistic inquiry, there will be a variance in data due to the fact that the sources are different; however, the method of establishing structural corroboration can be used to identify logical and reasonable reports of data in which variations can be identified and explained.

Transferability. The concept of transferability is somewhat more difficult to determine in the naturalistic paradigm. Guba (1981) validates the statement: "the naturalist's assumption that generalizations of the rationalistic variety are not possible because phenomenon are intimately tied to the times and the contexts in which they are found" (p. 80). However, Guba states that while it is not possible to develop "truth statements," some transferability can be achieved through theoretical/purposive sampling, collecting "thick" descriptive data, and a "thick" description of the context.

Project	Spontaneous	Building upon assignment	Incidental	Personal interests	Instructional videos
Carissa *Like I made a scrap book for my dad a couple of months back. I used electronics for that.*	Maggie *It's just ... I pretty much go on Twitter or Facebook. Whenever there's an interesting link, I'll click it. Then learn more about it if it's like super interesting, so a lot of weird facts, I know.*	Elizabeth *Especially when you get on a roll because for like some of our choir songs we did a remix from Rihanna.*	Debra *People on the Reddit, a foreign site might say, "Oh, this is how you get better, this is how you get better" . . . it comes down to is decision making, prioritizing, and knowing what to do.*	Melinda *Yeah, if I like a song, I will try and see if there is a recording of it on the Internet like YouTube or something and then if I can find it, I'll play along with it and practice.*	Josh *I really wanted to learn how to curve the ball in soccer. I thought that was really interesting so I would watch all these breakdowns and everything. Where to kick the ball? How to strike it with your foot? How to follow through and everything like that?*
Luke *Yeah, there have been projects that I've used ... Instagram, I've used to like make a project. I want to do like a collage, or like a Flipgram, which is basically a video of pictures.*	Josephine *If there's something that like sparks my interest, if I'm watching something on the news, or I hear about something that I really want to know about. Yeah, I'll look it up.*	Carissa *I did smell tests and all this stuff. I definitely, I love the nervous system. It's cool, but I like looking up stuff like your olfactory cell and frontal lobe*	Josephine *Probably more random facts than anything significant. I know that Twitter has now implemented a little news feed to where it shows a daily current event or something like that.*	Elizabeth *There's a whole bunch of stuff going around like detoxing stuff and how to ... There's these wraps that are going around too like just by oils it'll help you, you wrap it around and it helps you lose weight, something like that.*	Josephine *Once or twice I was not been paying attention in class and so I'll go on and see if I can learn how to do it.*

Figure 2. Key theme (self-directed learning), subtheme (six provided), and learning theory matrix: color-coded data, participant, and gender.

Guba (1981) states that theoretical/purposive sampling provides a specific group of participants that is *not* meant to be generalizable. Through this process, participants are selected based upon particular criterion that makes "emergent insights about what is important and relevant" (p. 86) possible. Using this method allows the researcher to be intentional in collecting

data that are relevant to the study and that will yield data producing a deeper understanding of the phenomenon being researched.

For the purpose of this study, aspects of transferability were addressed through theoretical/purposive sampling that controlled for the following criteria: the school in which the participant is attending, the program that the student is participating in, the age of the participant, grade level of the participant, the computer usage practices of the participant, and the ability of the participant to articulate his or her learning experiences while using digital technology within the parameters identified by the study.

Furthermore, transferability was addressed through the collection of "thick descriptive data." This descriptive data was provided in a manner that allowed for comparisons to be made where applicable. With the thick descriptive data that was collected, the researcher was able to provide the information required to "match characteristics" and "test the degree of fittingness." For the same purpose, the researcher developed a "thick description of context" that provides significant information for "fittingness" requirements to interested parties.

Dependability. Guba (1981) references that dependability for the naturalistic paradigm as somewhat complicated because the instrument which is used (the human instrument) often changes: "not only because of error but because of evolving insights and sensitivities" (p. 81). However, Guba states that dependability can be achieved through the use of audit trails that "make it possible for an external auditor to examine the processes whereby data were collected and analyzed, and the interpretations were made" (p. 87). Guba adds that the audit trail uses documentation in the form of interview notes, transcripts, and daily journaling to provide evidence of dependability. Guba further states that a dependability audit can be performed by an external auditor to determine the degree of acceptability of practice.

For the purpose of this study, the concept of dependability, as defined by Guba, was monitored through various matrices used throughout the data collection process. As shown in Tables 2 and 3 and Figure 2, all coding and analyzing of data, as well as notes taken by the researcher throughout the process have been maintained.

Confirmability. Guba (1981) notes that in the social sciences, objectivity cannot be achieved. Guba discusses the aspects of multiple realities and the inherent role that human predispositions play in naturalistic research. Guba states that in naturalistic research, "the burden of neutrality [is shifted] from the investigator to the data, requiring evidence not of the cerftifiability of the investigator or his or her methods but of the confirmability of the data produced" (pp. 81–82). Here the focus becomes the interpretation of the data collected. Guba notes that an effective way of confirming the interpretation of data is through "practicing reflexivity." Through this practice, Guba states the importance of intentionally revealing to the audience the underlying epistemological assumptions behind a set of questions and keeping a continuous daily journal. The journal is to not only serve as documentation for the research and method, but to serve as a way to reflect on the introspections of the inquirer and to share these introspections so as to reveal any changes in the inquirer as the study moves forward.

In effort to achieve confirmability in the study as defined by Guba (1981), in the study, this researcher has been transparent with the study participants of the study in regard to the purpose of the study and the assumptions that has led him to the process and questioning. Furthermore, the researcher has practiced being reflective on his own biases and beliefs in regard to technology integration. The researcher is utilizing the practice of "reflexivity" in making conscious efforts to question his own support for technology integration and challenging himself

to be more open-minded and aware of the possible limitation and detriments of ubiquitous technology integration into our society.

Limitations

Geertz (1973) describes the interpretivist process as "our own constructions of other people's constructions of what they and their compatriots are up to" (p. 9). Looking at the study through this lens, perhaps the greatest limitation is the ability of the researcher, as a digital immigrant, to interpret and construct meaning from the data of the participants, who are digital natives. Given that a primary goal of the study is to better understand how students of today use their computer devices when they are away from the school environment, there will be a barrier between what the researcher "knows" of the learning process and what the participant "knows" of the learning process. The researcher hopes to address this gap as much as possible through awareness and review of previously conducted research.

As the interviewer, the researcher was the primary data collection tool; and as such he continuously attempted to navigate between his own personal biases and experiences and the interpretation of the subjective experiences of the participants of the study. Furthermore, his own experience in qualitative research is very limited and as such will not reflect that of an expert with vast amounts of expertise and experience.

The length of the study was also a limiting factor. The study took place over the course of 3 months, in which during this time interviews were conducted totaling 30 to 45 minutes in duration. Because of the short time frame, the study provides a brief glimpse into the learning constructed by students away from the school environment. In other words, the study provides a limited view of the learning practices of the selected participants of the study.

Furthermore, students who were in their senior year of high school and who were 18 years of age or older were eligible to participate in the study; this criteria limited and only catches a small percentage of students participating in the one-to-one laptop program.

Finally, a significant limitation to the study was the researcher's role as an educator. Due to the researcher's beliefs as an educator that technology integration is critical to the provision of an equal education opportunity, it was a challenge to step outside of those entrenched beliefs and take a more critical look at the limitation and possible negative impacts of ubiquitous technology in and outside of the school environment.

Chapter 4: Findings

This chapter presents the results of the data analysis. Ultimately, the goal of the study is to use data gathered from the participants to better understand how students form learning with one-to-one computer devices when they are away from school. This insight will not only improve the understanding of benefits and detriments of ubiquitous educational technology, but may also have implications on the way in which we teach the students of tomorrow differently.

The chapter provides a brief description of the participants in the study, as well as a brief description of the data gathering and analysis process. The data are then presented as it has been categorized into various themes and sub-themes focusing first on access, and then followed by student freedom, and identity development. The chapter will conclude with a point-by-point summary of key findings from the data analysis.

Description of the Participants

The participants selected for the study were in their senior year at Hadley High School; all 12 of the students were 18 years old at the time of the interviews. Of the 12 participants, 6 were male and 6 were female. Each was selected and invited to participate in the interview based upon their use of computer devices when away from the school environment. All 12 of the participants reported extensive and expansive use of computer devices when they were away from school in some capacity, whether it be at home or in another location.

Data Collection Process

Data collection first took place via a voluntary student survey which was designed using the program "Qualtrics." Based on the survey data, six male students and six female students were selected to participate in the 30- to 45-minute interview.

The second part of the data collection consisted of the selection of 12 students to participate in an open-ended interview. The data from these interviews was coded using the Mocker and Spear learning continuum of: formal, nonformal, informal, self-directed learning. In addition, other significant themes that emerged from the study, included access, efficiency and ease of use, shared experiences, college preparation, workforce preparation, digital citizenship, entertainment, and lastly, the challenges of technology. The data was then further analyzed and reviewed in regard to student use and the broader scope of the study in relationship to the participant's formation of learning with the computer devices in regard to the learning theory continuum.

Analysis Process: Thematic Analysis

The study's theoretical framework provides four major theories of learning in which to view the participant data: behaviorism, cognitivism, constructivism, and connectivism. Furthermore, the researcher uses Mocker and Spear's (1982) model of lifelong learning to help distinguish between various types of learning activities: formal learning, nonformal learning, informal learning, and self-directed learning. Along with these, other themes emerged throughout the coding process that are significant to the student's technology-driven learning experience when they are away from the school environment. These additional themes are combined and presented with the learning models in a specifically organized and coherent narrative for the purpose of the study. The data reveals significant themes in regard to access, student freedom, identity development, and ends with the Challenges and Barriers of Ubiquitous Technology.

Access

The researcher will begin with the theme of "access" because of the importance that it plays in technology—and in particular, the role that it plays as the driving force behind one-to-

one laptop initiatives. As the study views the learning process of students with technology when they are not in the traditional school environment, the role of one-to-one or ubiquitous laptop initiatives and the provision of digital devices takes center stage in terms of ensuring that all students have access to digital devices on a consistent basis when they are away from the school environment.

All 12 participants in the study made references to the importance of access to technology when they are outside of the classroom. The participants referenced the benefits of having a consistent connection to technology when they are away from school in the form of: extended learning opportunities, access to multiple devices, access to multiple sources of information, instant access to vast amounts of information, and equal access to information with their peers. Furthermore, detrimental aspects of access were noted by participants in that ubiquitous access to technology may bring distractions to the learning process.

Computer devices and extended learning opportunities. Consistently, both male and female students spoke about the advantages of having extended access to digital devices when they are away from school as well as opportunities for extended learning. Carissa states, "Whenever we have a project or a paper or anything, I usually stay up kind of late and just type it out." She references the distractions that often take place in the school environment and states that she is able to "better concentrate" when she is at home by herself. Similarly, Debra values the extra time that the digital devices provide because she feels that the teacher did not allow for enough time on the assignment in class: "I've probably done about 2 hours outside of class . . . because [the teacher] didn't give us enough time in class and it was due that night." She also places an emphasis on extended due dates and the availability to submit a paper in after-school hours: "[the assignment] wasn't due until midnight most of the time which was nice . . . instead

of it being due that class period or due at the end of the day . . . it would be due at midnight." To some extent, all students referenced the benefits of "extra time," but some specifically recognized the benefits of learning management systems (LMSs).

LMSs are software applications that allow for the delivery of electronic educational technology. In other words, teachers are able to post assignments and resources online for students to reference when they are away from school. Luke states:

> [I have] the ability to just access it from just about anywhere. I'll be able to login to my school account here at school and do whatever I can of the homework here; then, when I get home it's already there. It's saved automatically. It's perfect for homework.

Ryland references a specific teacher that uses the LMS on a frequent basis: "For Psychology, Mr. Frankfort . . . has some kind of Google website . . . and he posts the [class] notes, and he'll put links to the website Quizlet for the vocab and stuff and just various resources for the class on there." Here the students claim that it is advantageous to have access to these materials and resources when they are away from school because it provides them with more time to learn and complete educational tasks. Furthermore, students mentioned that LMSs are often used by their teachers to introduce outside resources for instruction.

Computer devices and access to multiple resources for information. Luke spoke about referencing other instructional resources online when he was away from school to aide him in comprehension: "Yeah, a lot of our assignments are posted online. [The teacher] will give us a homework update on My Big Campus (learning management system). Then [I will use that] and online math resources." Carissa also states that having access to digital devices away from school allows her to seek other instruction from online resources such as Khan Academy, which began as an instructional site for mathematics but has rapidly grown to include multiple disciplines and content areas. She states,

> It's a lot nicer, so you don't have to wait to the next day to maybe talk to the teacher . . . some teachers just don't know how to explain it as well as someone else. It's like a good other source than just relying on the [teacher].

This quote is representative of many of the participants who stated that instructional videos are excellent resources, and in some cases better than their teachers, for comprehending complex materials.

While the large majority of the time students spoke of the benefits that the digital devices provided, it is worth mentioning that participants noted some negative consequences from ubiquitous access to the technology. When discussing access, it was often mentioned by participants that the omnipresence of technology often posed a distraction from their academic work. Ryland states, "I think with technology, it's easier to get sidetracked from doing what you're supposed to be doing . . . schoolwork that'll take 20 minutes turns into an hour-long process." Ryland also stated that having the ability to access his homework and class notes at home led him to sometimes pay less attention in class: "It's just in the back of my mind like, 'Oh, you don't have to pay attention right now, you can do it later.'"

Ubiquitous access to information with computer devices. "I don't know. Like, technology helps me have more access to everything, anywhere, and anytime" (Carissa).

Another common topic discussed by the participants is the phenomenon of constant access to information. Throughout the interview process it became apparent that the students recognized and valued the instant availability to information that having the digital devices in a ubiquitous manner provided. They perceived this as advantageous and necessary to being a student and citizen in the 21st century. Maggie states,

> Yeah, I think it's kind of like a personal library kind of thing. Instead of going to a library and finding a book on whatever . . . you just kind of Google it and [it's] kind of the library of the world. It's just there when you want to use it.

Another student, Ryland, not only recognizes the limitless of information that the digital devices provide, but addresses the time in which it takes to get information: "I think it's nice having technology for certain things because it's easier to access new information . . . but the Internet is faster than books. For things that I need to know now, technology is good."

Participants often referred to the search for information on the Internet with their devices as "googling it." This term derives from the popular search engine, Google, and has taken on a pop-culture action as a verb, *to google*. No matter the use of the term, the participants referred to the process of researching the answer to a question as something done instantaneously from their digital device. Carissa states, "I usually just type in the question and it usually just pops up—so I just go to the first link." At several times throughout the interview process participants speak to the action of accessing information in a ubiquitous manner. It is evident that the possession of digital technology at all times provides students availability to unlimited information that can be obtained at any point in their day. Or as the participant stated above, "access to anything, anywhere, and at any time."

Efficiency and ease of use through access to computer devices. "It makes everything run really smoothly" (Melinda).

Another emergent theme throughout the interview process was "efficiency." At some point, each participant referenced that having access to technology away from school made various aspects of their learning processes "easier." Most of the references can be coded in regard to a central location of information versus having to look in multiple sources in more than one location. Secondly, most of the participants spoke in regard to "composing" writing and homework and how the presence of their laptops made these processes "easier," although there are two students who discuss the limitations on this process.

Computer device access and central location of information. Along with the near ubiquitous integration of technology into the classroom has come a change in the way that teachers deliver information. Several teachers create websites and "post" notes, assignments, readings, etc. on these sites so that students have easier access to information. Ryland states, "Mrs. Houston, she has a Shutterfly website. She puts all of the documents that we need from class on there. Usually, I'll get on my school laptop, and I'll go and pull up from there for homework." This participant also references the use of Google Docs and the compatibility that exists between the school laptop, Chromebook, and the Google Docs application; he states that it is "a lot easier than getting on the home desktop" when it comes to accessing class notes and homework assignments. Melinda says:

> My Big Campus is basically a way for students to turn in assignments online. . . . You can log in to your account, see what schoolwork you have, and submit classes online. Mostly, I use that for my computer class. It makes it really easy for our teacher to grade it through that way.

Josh specifically compares the use of an encyclopedia to conduct research versus the use of his laptop. The term that he references is "convenience," and states that previous to having his school laptop, he often had to visit the library to refer to encyclopedias for information; noting that now "it is much easier to use the technology."

Luke mentions, "It's made it easier to take that initiative outside of school and outside of classes. To be able to study online, access the Internet, that kind of thing makes it a lot easier."

Computer device access and composition. It was common for the participants to address the writing process when asked about using their digital devices at home. For the most part, the participants referenced the "ease of use" in regard to the writing and editing process; however, two students stated a preference for "pencil and paper."

Josh points out,

> what I really like about the [school laptop program] is that I can type up a paper really quick. If I need to look something up while typing a paper I can have that, I can just switch between tabs really easily.

Josephine states that the technology allows for her writing to be clearer for the teacher so that she can get better feedback and edit more quickly:

> Yeah, if I write, it not going to be legible, so I think being able to type it, and also when he goes to grade it, we never have to print anything out. He can just type right on there exactly what he wants to tell us and highlight what it is he's talking about and those are really cool things because then I can just get back on it and fix it right there instead of having to print out and then going back to my original.

Elizabeth mentions that it is "easier to take notes" due to her typing skills. She says that often times the teacher speaks too quickly for her to write notes and that her laptop provides her the ability to capture what the teacher is saying so that she has those notes with her at night when she studies. Elizabeth also references composing projects where she needs to have access to pictures. She states, "Sometimes it's easier, because all I have to do is set up a computer and there's two hundred pictures instead of, cost-wise, printing them out."

Interestingly, there were three participants who expressed hesitations when it came to typing with their digital device. Ryland acknowledges, "I'd much prefer to write a paper because it feels a little more personal." Elizabeth references the sometimes unreliability of technology and states, "sometimes it's harder though, because if you don't save it correctly, you have to do the whole thing over." And Josephine notes that she not only prefers the more traditional method of writing, but also finds technology often cumbersome:

> I'm a big fan of pen and paper, so it'd probably be easier for me personally to bring a folder with a worksheet in it somewhere outside of school to work on things than it would be for me to have a laptop and a charger and things like that if I wanted to work on it somewhere besides home.

Most of the participants were in favor of the use of technology to provide "easier" and more "convenient" access and use in regard to activities away from school. It is worth emphasizing

that the participants stressed the ease of access to various amounts and types of information from a single source and in a single location. To use an earlier quote by Carissa, "I don't know. Like, technology helps me have more access to everything, anywhere, and anytime."

Computer device access and shared experiences. A key theme that emerged throughout the interview process was the concept of "sharing" experiences through technology. On some level, all participants spoke on the greater ability to communicate information with multiple others who are geographically near and far away. Participants spoke of shared learning experiences where they are able to collaborate with classmates in order to work on assignments and discuss ideas. The participants also spoke extensively on the ability to share "life experiences" with others through the use technology. All participants mentioned that access to computer technology allowed them the ability communicate better with their family, friends, teachers and classmates, do it on an "informal" or "self-directed" level, and gain and share vast amounts of information and learning.

Shared learning experiences with computer devices. In relation to the structure of the interview questions, all participants spoke first on the ability to share learning experiences with others. Luke points out that he can engage and communicate with his classmates from almost anywhere, due to his access to technology, stating:

> I can be sitting at my computer and [receive] text messages from my laptop. Little things like that to communicate; e-mail and even going back to the Google Drive, the ability to collaborate with people. You're not in the same room, but you can work together on the same document. Even as simple as notes from a class; being able to share it with someone, and then you and that person can collaborate together on it and work on it together. It makes it a lot easier to do things.

To some degree, all participants referred to assignments where students must share their writing with a certain number of classmates; each student must peer edit the other's work—and

Josh remarked that the technology has not only made it easier to do, but easier to do with more people in order to receive additional feedback.

During the interview process, all participants mentioned "Google Docs" and commented that they not only had the ability to share information through technology, but that they, as a collaborating group, had the ability to work on the same document at the same time. The participants commented that this provided a "new" way of collaborating as it is instantaneous and greatly reduces the time necessary to communicate and work together.

Computer devices and distraction. Participants commonly referenced that the technology in which they are using to complete homework, research, etc. can also provide a very tempting distraction and pull them away from their task at hand, thus turning what might be an hour-long session into 2 or 3 hours. Ryland states, "with technology it's easier to get sidetracked from doing what you're supposed to be doing. Doing schoolwork that should take 20 minutes turns into an hour-long process." And Parker comments, "It can be distracting because the person has access to all that [games and social media] and yet also has to study for a test." Ryland further notes that many times he will be working on homework assignments while using his laptop and then get "bombarded by 50 of his friends" who are trying to communicate with him. And Elizabeth informs that her access to technology will often cause her to procrastinate and not pay close attention in class:

> I think that having the ability to just say "oh, I will do that at home," it's in the back of my mind and so I think "I don't have to pay attention right now, I can do it later."

Student Freedom

The researcher uses the theme of "freedom" because of the importance of student choice in the learning process. As students gain more freedom in regard to how they will learn and what

they will learn, they progress along Mocker and Spear's (1982) learning continuum toward what the authors call the "ultimate state of learner autonomy." With the goal of complete learner autonomy, or self-directed learning, students are better prepared to become lifelong digital learners in a society where knowledge and the means to attain it are rapidly and ever-changing.

All data collected from the study has been analyzed and filtered through the lens of "freedom" in regard to the learning process. Mocker and Spear's (1982) four categories of learning: formal, nonformal, informal, and self-directed, provides a continuum through which to view the reported learning activities and the student's ability to control the means and objectives.

The researcher also visits another aspect of the theme of "freedom," or lack thereof when participants report that ubiquitous access to computing devices often limits their freedom to separate themselves from the school environment. Said differently, the participants reported that along with the freedom to learn outside of the school setting came the expectation from teachers that students be "connected" to school-based learning during time when students traditionally explore interests of their own.

Formal learning with computer devices. This section of the chapter discusses the learning model of Mocker and Spear (1982). Mocker and Spear state that formal learning occurs when learners have little to no freedom or control over the objectives or means of their learning, and that the common characteristics that are required for classification as formal learning is that the decisions regarding the objectives (what is to be learned) and the means (how is it to be learned) are made by someone other than the learner (Mocker & Spear, 1982).

This type of learning, when taking place outside of the school, is typically the result of assignments made by teachers or others in the form of "homework." However, it can also come in the nature of state requirements for diplomas, certificates, etc. During the coding process, the

following themes emerged in regard to the "formal learning" that the participants described: homework, writing assignments, projects, Internet research, credit recovery/graduation requirements, and assistance.

Homework with computer devices. While many of the homework tasks are basic, the participants spoke of ways that access to technology away from school allowed them to do the homework in a more efficient or "broadly" accessed manner. First, the participants stated that their teachers mostly use LMSs to post their homework and locate documents and resource links that are necessary for the homework assignment. Luke states,

> Yeah, a lot of our assignments are posted online. [The teacher] will give us a homework update on My Big Campus. Then [I will use that] and online math resources. . . . We use Google spread sheets a lot . . . and whatever [Google's] version of Excel is.

On some level, all of the participants referenced either "My Big Campus," which is the school's adopted LMS.

Both Ronan and Elizabeth referenced the use of their devices away from school to monitor stocks to meet a requirement for homework. Elizabeth says, "Every day we have to check our stocks, so I check them every day. You have to do it—it's a portfolio type thing over the companies that you invested in." And Luke explains that he must use his devices to create graphs and charts for his business class, as well as use Google Surveys to access demographic information for homework assignments.

Debra explains that she takes a dual-credit course through the high school and Ivy Tech, and stated,

> English is all on the computer, because it's just writing papers and we have to have the computers to do that . . . we're pretty much S.O.L. [if we don't have the computers] because the computer is what allows us to do the work away from school.

And Josephine says one of her classes is show choir and they record their session with their choreographer, who travels from Chicago, so that they can watch their practices online from home:

> Yeah, our choreographer comes down from Chicago, and whenever she teaches us, it's usually about a 3.5 hour stint that we're learning it. At the very end, after we have all pretty much gotten it right, someone will record the whole group, as well as the choreographer doing the choreography, and then our teacher will upload the video on to Facebook. We have a choir page on Facebook that everyone is on, so we'll upload it onto that page and that way, when you go home . . . you can just watch the video.

To some extent, all of the participants referenced using their devices away from school for very basic activities, such as using the device to access search engines to look up the definitions to vocabulary assignments. Also, all establish it as a basic calculating device; however, Brendan states, "I use my iPad for my calculator because it's blown up. It has all my trig functions and I can use it to do calculus. That's a lot easier than using a small calculator."

Homework assistance with computer devices. It is important to note that many of the participants specified getting "help" for their homework while using online resources. Earlier we heard Carissa discuss her use of Khan Academy to access instructional resources for a broad range of topics. Furthermore, Brendan mentions of a "hotline" that a local college has set up to help high school students:

> Rose Hulman has a Web site that you can go on and they also have a hotline that you can call—and they explain it to you step by step. They're all Rose Hulman graduate students . . . they're smart.

Creating projects with computer devices. The participants also spoke at length in regard to "projects" that were assigned to them by their teachers who required the use of a computer to complete outside of school. The projects that the participants spoke of varied greatly, and most

of the students noted employing their devices to use Microsoft Power Point or Prezi. Josephine states:

> We have a project where you could write a paper based on articles of the government and you do research and you find all of your articles online . . . you get to do a lot of cool things and being able to stand up and present your point of view, usually you can get stuff off across better than just turning in a piece of paper.

Many of the participants referenced using their devices when they are away from school to do research for projects of this nature and the ability to work extensively on these projects when they are at home.

Ronan referred to an assignment for his Project Lead the Way class where he is able to access a specific software that has been downloaded onto his school computer. He is able to use this anywhere that he has his device and stated that the majority of his work is done at home:

> Pretty much we go on this program called Inventor and we draw shapes, pull them off to make 3D models and then after that, drill into it and combine it in an assembly to get all of our parts we made throughout the week into a final product.

Debra remarked about an assignment from her economics class where she worked extensively away from school on her computer to "make a slide show for entrepreneurs and investors" and also complete a project where she is "graphing the stock market."

Two of the participants mentioned that they have a requirement to complete a "senior project" that involves creating a slideshow. Carissa comments: "We have a senior project that we have been doing the whole year. You can download iMovie and just make a whole slideshow presentation with it and put music from your iPhone with it." Elizabeth also referenced the project, but added that she also uses her personal computer at home because that is where the "personal things that [she] needs" are located. Both of these students express that almost all of

the work for the project was completed away from school and was designed by the teacher to be that way.

Credit recovery with computer devices. Important data that emerged throughout the interview process was that three participants disclosed using their digital devices outside of the school environment to complete "credit recovery" courses. These participants voiced that in order to get the amount of high school credits that they need, they took one or two online courses through a software program called, PLATO. Elizabeth states:

> Anything that you failed or if you need more credits, then they pick a class and you just do it online. . . . They have different types of sections, so there's probably five or six assignments in each one and then a couple tests. So, whatever I understand I do at home.

Nonformal learning with computer devices. Mocker and Spear (1982) define nonformal learning as the process that occurs when learners have the freedom to control the objectives but not the freedom to control the means. In this type of lifelong learning, the individual has some responsibility in the decision-making process. Learners make decisions on what is to be learned, but seek help on the how or means of the learning activity.

Most of the participant data within this realm of learning came in the format of student choice concerning topics to study for a project or a writing assignment that involved an extensive amount of research. Here, teachers clarify the assignment of creating a project that addresses various aspects of the taught curriculum, but provides the students with the choice of what they would like to research and then present to the class.

Two of the participants referenced "freedom" when selecting the topic for their senior research paper. Both of the participants stated that they were able to "choose a topic that interested [them]," but that the teacher still had to approve the topic. Luke specified a site called "Reddit," which he visits when he needs help with his homework. In describing the site, he

compares it to social media—but for specific questions: "They go by usernames, so it's all anonymous. One person can post a question, and then instantly you'll have one hundred responses to that question. Here, people get together . . . it becomes a community."

Informal learning with computer devices.

> When you're [using] a textbook, there's only so much you can learn because it's all that's there. When you're on the Internet, you can surf the Web and find different websites. I guess that you have more options on the Internet. (Melinda)

Mocker and Spear (1982) define informal learning as the type that takes place when learners have the freedom to control the means but not the objectives. The authors state that the institution maintains control of the goals of the learning activity while permitting or assigning a degree of responsibility for the means for achieving those goals to the learners. And as Melinda states above, the access to digital resources at any time around the clock provides a great amount of freedom to these student in controlling the "how" of the learning process, once they have been given the "what."

Findings in relationship to informal learning have been placed into two sub-categories, "Alternate Instructional Sources" and "Individual Learning Styles." As the participants elaborated more on how they used their devices to learn, it became evident that alternate sources were being used by the students to get assistance to learn materials that they did not understand in the traditional setting. Furthermore, without explicitly stating awareness of their own learning preferences, the participants described using their devices to learn differently from the structure set in place by the teacher.

Alternate instructional sources and computer devices. Melinda also establishes that she "sometimes looks at different articles just to get a different point of view to see if I can feed off of that or if I want to formulate my own idea," thus giving her the freedom to search for various

angles and points of view of a topic, rather than only being exposed to one. Luke says that "there are hundreds of websites out there for language learning. . . . [I] log in to them and have the ability to go onto websites built in Spain or in Mexico and use them as a native source." He states that being able to do this allows him the opportunity to experience the culture that he is studying through something that they created, versus something that "we" created.

All participants provided a broad range of examples of using resources that they chose from the Internet. Melinda spoke the most on the topic and stated that when working on projects that have been assigned at school, she often selects from an array of different Web resources: "there have been projects that I've used Instagram . . . and if I want to make a collage, or a video of pictures, I will use Flipgram." Maggie spends most of her time working on calculus and physics when she is away from school. She states that she often uses Khan Academy for her calculus course and that "Yahoo! Answers is really helpful in explaining how to do a problem."

Individual learning styles and computer devices. Perhaps some of the most intriguing comments were made in regard to a student's individual learning styles. Each participant referenced how having access to technology away from school helped him or herself in a personalized way. Several stated that without the outside learning resources, they would have performed much more poorly in the course, or even failed. Josephine asserts:

> I think that everyone learns a little bit differently. A lot of people feel perfectly comfortable in a loud, chaotic environment, focusing on what they can do. I personally, have ADD, and I cannot work in an environment where there are a billion other things going on . . . when it comes to content and really getting into things, I have to work outside of school. Being able to work outside of school is the only thing that gets me through the class, actually.

Other participants discussed the visual advantages of having access to digital technology when away from school. Melinda notes, "For some of the novels I read in class, I want to get a visual of it. I'll look up a video on YouTube to get a movie in my head, to see what it looks

like." To quote Brendan, "Repetition is key for me when I'm trying to really learn something, and there's actually some really great videos that are easily accessible." This participant specifically mentions two brothers, John and Hank Green, who post a series of videos on a broad range of topics. Brendan states that he often views these instructional videos through YouTube and watches them repeatedly until he grasps the concept.

Carissa participates in the school's show choir class and on the performance team. She affirms that her success in the class and the competition not only depends upon visual repetition, but audio repetition, as well. Carissa references watching and listening to performances of other groups who do very well:

> You hear how they sound, so then you make yourself try to sound like that. Then you can tell, if you listen, when you're singing if you don't sound up to that level. You can compare and [notice that] I need to drop my jaw more or breathe deeper.

And, Ryland expresses the benefits of being able to play music on his device while at home. When referencing using his device(s) to learn notes and chords for the school orchestra he states,

> I usually do it on my own because sometimes when I'm in class, I have to play real slow so I can learn the notes. Eventually, we are going to play at the correct speed so I can practice at the correct speed.

Brendan describes a similar scenario, but talks about the advantages of having the ability to play his music back because, "there is a lot of difference between what I hear and what is recorded. . . . There's a lot of biased gap in it; there is no bias when you're listening to a recording."

Self-directed learning with computer devices.

> I learn a lot, but it's for education. But whenever I research online for myself, it's kind of just for me—just to look at something that I am interested in. It's to make a better name for myself, not anything that anyone else told me to do. (Elizabeth)

Mocker and Spear (1982) recognize self-directed learning as that which takes place when learners have the freedom to control both the objectives and the means. Self-directed learning, as defined here, represents the ultimate state of learner autonomy, i.e., the student exercises control over and major responsibility for choosing both the goals and the means of the learning. The learner not only selects, but may also reject, add, or change resources at will, decide to continue or terminate the project, and finally determine the satisfaction or adequacy of the outcomes.

Findings coded under the theme of self-directed learning haven been placed into the following subcategories: building upon knowledge, pursuing personal interests, unintentional sparked interest, gaming, and health and well-being. Each of these subcategories has been coded in an effort to provide the reader with insight into how the participants explore and create, intentionally and unintentionally, when given the opportunity to freely choose what information to pursue and how to pursue it.

Building upon knowledge using computer devices. The participants referenced using the knowledge gained from assignments to conduct their own research and learning in regard to their personal interests. The emergent pattern was that the students enjoyed the formal learning process and the resources that they were taught to use for their courses and therefore, used the same resources to perform tasks that they found intrinsically rewarding. Three of the participants mentioned that they had applied the same process and instruments to create their own senior year slide show that they had previously employed for a mandatory senior project. Brendan discussed an app that he used to create a slide show when he was at home: "You can stream music and put in pictures, everything that you want to do." And Elizabeth stated,

> After you graduate, you have a little party, so that people can congratulate you since you graduated. A lot of people have pictures, so I am using the [school software] for my senior pictures and then I am adding my childhood photos and other fun stuff on there.

And Melinda used the school software to create a scrapbook for her dad.

Another student applied the information that she had learned at school to continue another "assignment" that they chose to do based upon their own interests. Carissa enjoyed a science project that regarded studying the nervous system so much that she conducted the same experiment on the olfactory system. She stated, "I did smell tests and all of that stuff. I like looking up information on the olfactory cells and the frontal lobe." The same student also used digital technology and software from school to create and conduct her own performance with her friends from her choir class. Using the same process of recording their practices and the performances of other groups and posting them onto Facebook so that the students can practice outside of school, the girls chose a song that they liked and recorded a performance on their own: "we did a remix of Rihanna; 'We Found Love' it is really awesome."

Gaming with computer devices. The participants, both male and female, commented much less than the researcher expected in regard to gaming. The majority of participants mentioned it on some level, but they did not place a large emphasis on the amount of time that they spent engaged in gaming. However, the participants were able to speak on learning that takes place while gaming. Josephine states:

> Something that I think is pretty underestimated about video games in general, is that they actually do help you think critically. In Pokémon, which is kind of a funny example, you have to battle other Pokémon and you have to know fairly quickly what's going to be your best option, so you have to think fast and you have to think critically. . . . Everyone's got to learn about critical thinking and I think you actually do a lot of that when you play video games.

Ryland credits video games with enhancing his ability to multi-task: "I would say that playing video games, it does seem to have some effect as far as being able to pay attention to

multiple small things at once." And Luke remarks about critical thinking, as well as physical benefits:

> From the games you have hand-eye coordination with a console game. You get logical skills from the games. For example, the Indie Horror Games, you have to rely upon your instincts to stop whatever it is that is chasing you. You really have to use logic, looking around, noticing your surroundings to try and find what can help you in this situation. It gives you a fight or flight instinct.

While most of the participants referenced critical thought, some did mention the aspect of competitive nature when playing with others in regard to scoring on a specific game. Ronan speaks of "ranking systems" and following his rank on games and being involved in the process enough to seek outside help on the Internet to get better. He comments on visiting "foreign sites" to elicit help from bloggers who are experts at the game so that he can improve his scores and gain advantages over his opponents.

Digital citizenship and computer devices.

> I learn a lot about other people who maybe don't have the same beliefs as me. I kind of learn what it's like to be in the shoes of someone that doesn't think the way that I do, have the same religion as me, or even the same sexuality. (Maggie)

Throughout the study, it became more and more emergent that the participants relied heavily on their technology to stay informed and involved with the larger world around them. Through their devices the participants received their "news" on current events, and it is what they used to view the world beyond their local surroundings. It many instances, the participants spoke of using their devices to access local news and events. They commonly reported that they do not watch the news on television, and they do not read newspapers or magazines. Instead, the participants told of getting their news through "news feeds" online, whether it be through a direct search, or most likely it is information that is already posted or "pops up" on a site that they consistently visit for other purposes. Carissa references a local event: "I'll see something about

an accident and be like 'oh, what happened?' like when the wreck happened the other day on highway 144. The truck was engulfed in flames. . . . I looked it up and found pictures of it." The participants also overwhelming stated that they received information for weather through apps that are on their phone or their computer. Parker expands, "I've downloaded a couple of weather apps. . . . I try to see what's updated and try to keep traffic information as well as weather." This revealed another common theme, and that is the expectation that the participants get "important news" and weather updates immediately.

The participants also used the devices and access to the Internet to stay connected with the larger world around them. The participants spoke in reference to global news and events as frequently as to local news and events. In fact, some participants noted that global events often overshadowed local events on their devices—and as a result, they are more informed in regard to global news than they are about the local news. Maggie remarks,

> I feel like I am getting more culture if I am seeing what it's like I someone else's shoes across America . . . there is so much to be learned by watching a vlogger who video records their life. You can see kind of what's going on in Philadelphia or Florida without have to go there yourself. It's kind of cool to step back from my life and not have to think about Harrisonville. . . . I can watch someone in Canada or somewhere and see what life is like in their shoes.

As a result of this easily accessible information, the participants reported feeling more connected with the larger world around them, not only because they have information from around the world, but also because they receive that information almost immediately and are "sharing" the knowledge with the world.

The participants also used their devices to be "socially active." The participants reported using their access to technology and information to learn about important social issues around the world. Josephine expressed that her passion is for animals and the environment. She states that she learns about renewable resources when designing habitats for zoo animals and that her

goal for the zoo is to use a lot of wind and solar energy so that she can minimize her carbon footprint. Other participants informed that they will intentionally make purchases based upon what the corporation supports or promotes. The participants did not refer to boycotting a company because they did something bad, but the participants referenced purchasing from companies that support a cause that they believe in. Brendan remarks,

> A lot of what I'll do is I'll research and find a product that is serving a good cause, I will pay more and go out of my way to buy that product over another one. For instance, there are companies that just make bubble gum; you can buy any brand of bubble gum, but the difference is that a portion of their costs goes toward a really good cause.

Josephine mentions on a similar company called "Rocket Fizz" and says, "It says it right on the bag. It says what percent of the money goes to what cause. . . . I just thought that it was the coolest thing ever, so I started buying those."

Even when the participants were not commenting on purchasing with a social conscience, they did refer often to how their access to digital devices and the Internet has impacted them as consumers. They often referred to the convenience of shopping online and stated that it not only saved time and resources, like the cost for gas. Carissa noted that there are often only "sales" and "deals" that you can only get online: "If you go to the store then it could be 50% off, but if you get it online it is like 75% off." The participants remarked that it is much easier for them to comparison shop on the Internet because all of the information is right in front of them and that several shopping sites allow them to do side-by-side comparisons of products and prices. Debra states, "My mother and I are coupon queens and retailmenot.com is my BFF. The coupons are out there even if they're just for membership only. . . . I'm finding good deals." The participants did note that when shopping for clothes it was not always beneficial to do it online because they

may not get the right size, but the majority of the comments made were in favor of technology allowing them to be better and more efficient consumers.

When ubiquitous computer access is too much. It is often assumed that the induction of technology into the lives of individuals is a good thing. Furthermore, it is presumed in the field of education that technology integration is crucial to student achievement in efforts to keep up with federal education mandates, such as No Child Left Behind, and to compete in the global market (Prensky, 2010). However, some participants in the study spoke on how the ubiquity of technology impeded upon their personal freedom and often felt "overwhelming."

Elizabeth addressed the "pressure" that is placed upon students in today's society, and how access to technology seems to "add" to this pressure and workload. She references her daily schedule and how busy she is:

> I go to school for five periods a day, then I intern somewhere, and then I usually have after-school practices that I come back to school for every single day. It's not unusual for me get home at 9:30 P.M.

She states that even with these activities, she still must complete her homework that has been made available to her online.

Maggie shares some of the same beliefs that Elizabeth expresses above. She states, "my teachers expect each of their own classes to be the number one priority which can sometimes be very difficult and time consuming." She, too, references how busy her schedule is—as she is involved in several athletic activities. Both of the participants assert the perception that their teachers do not fully recognize how much each student has to do, and the teachers feel that since they can do so much outside of the school day through technology, that they assign more.

Carissa mentions the frustrations of 24/7 access stating, "now people can just get ahold of you 24/7, so now everything becomes more difficult because you are always 24/7, no matter

what time—they can just talk to you or send you e-mails." Ryland also speaks to the concept of ubiquitous access and references getting "bombarded with 50 different things at once," and constantly receiving "friend requests" or "instant messages." Both Carissa and Ryland express frustration in regard to ubiquitous access and the desire to not constantly be accessible.

Identity Development

All participants provided narratives in regard to how they are using their access to digital technology to better develop and discover their personal interests and identity. The students utilized their ubiquitous access to digital technology to seek out information and learning in regard to their personal interests, and furthermore, they learned from the personal interests of others. In turn, the participants further developed who they are, what they know, and what they believe—which better serves them to prepare for their future in learning and education. The students were likely to in turn share those beliefs with others, creating a cycle of growth, understanding, and identity development.

The following section is organized so that identity development can be observed first through the personal interests of the students, the sharing of information with others, and how they will use their personal interests and development of identify to guide future decisions in regard to post-high school activity. The following subthemes have been determined: pursuing personal interests with computer devices; sparked interests with computer devices; computer devices and social interaction; health and well-being research and computer devices; college preparation and computer devices; and workforce preparation with computer devices.

Pursuing personal interests with computer devices. Participants reported a broad range of activities that they chose to "study" and learn about when they were away from school. Some of the participants utilized their access to technology to research athletic activities. Ronan enjoys

playing soccer and is a member of the high school soccer team. When teaching himself how to "curve" the soccer ball, he recalled, "I thought that [curving the ball] was really interesting, so I would watch all of these [video] breakdowns . . . where to kick the ball and how to strike it with my foot." He also referenced using similar videos to learn other soccer skills that interested him. He noted that he could go back and forth in between watching the instructional videos and practicing until he got it correct.

Another student, Brendan, employed technology to make himself a better golfer. He stated that he would take videos with his phone and download those videos onto his laptop computer. He could then send the videos to his instructor and receive feedback. He would also take the laptop device with him when he played so that he could track his stats:

> They have an app where you can log your rounds. It takes average stats for putts made, putts taken, driving distance. . . . It's all GPS oriented. It makes me wonder about telemetry and how satellites work . . . it's pretty cool.

Other participants spoke about using the technology in regard to their love of music. Luke expressed his love for jazz music and noted that he does not get to play that genre of music when he is at school. He states that when he is home, he uses his laptop to look up performances of jazz music and learn the chords: "One session can become so many different things. I can start out with a music video, which may lead to viewing someone making a cover of the song." He notes how easy it is to spend a large amount of time going from one video to the next learning new music that he has never heard before. And Josephine states that she uses her digital technology away from school to learn about musical theatre. She explains, "I am a big fan of all things theatre, so I spend most of my free time online watching some kind of musical, choir, or something." She notes that she is unable to see performances because she does not have anywhere local that she can go, and even if there was a theatre close by, she has little money to

attend. However, she references that her access to the digital world does provide her with a glimpse of these performances through videos that are on the Internet.

Other participants voiced much more individual interests that they pursued through digital technology. Elizabeth states, "I like photography, so I take pictures of my niece. I took her Easter pictures and pictures of my family. It's just fun to see what I can make on the computer." She notes that she is able to edit and "touch up" the pictures that she takes when using her laptop and software that she has purchased. She says that this enables her to pursue and grow in her love of photography.

Brendan expressed that he has a passion for astronomy and uses his laptop device to "follow a couple of astronomical things and learn about the stars." And, Carissa uses her device to learn new hair and makeup techniques. She explains:

> I usually watch instructional videos for hair and makeup kind of stuff. There's this thing called a waterfall braid—I can only braid normally, so I just type in waterfall braid on YouTube and there's plenty of videos out there where they just show you how to do it. You can stop and pause and then go through it so that you have something to compare it to.

While Debra shares a passion for hair and makeup as well, she also uses her device to become a better cook: "Because I had no idea how to make cake balls" she watched several "how to" videos and then made batches of cake balls for her family and friends. Even the most simple of topics were pursued on the Internet by the participants. When faced with moving from her house to her apartment, Debra "googled" the term packing and storage so that she could receive ideas on how to be more efficient and organized.

Sparked interests with computer devices. The participants often spoke about spontaneously researching topics that either "popped into their mind" or were presented to them while browsing the Internet. The common occurrence was that they saw something that

interested them, and then they began to search for more information on the topic, which often led to searching for information on other connected topics. Ronan describes it as, "I pretty much go on Twitter or Facebook—whenever there is an interesting link I'll click on it. If it is super interesting I will learn more about it, so I know a lot of weird facts." Ryland makes a similar statement in regard to music: "If I'm listening to music and I think, 'oh, I really don't know a lot about this artist,' I'll go search them on the Internet and then learn a whole bunch of facts about the artist." The participants attribute most of their actions to natural curiosity that occurs when exposed to something that interests them. They comment that due to their access to technology, they are able to seek information when the "moment hits them" and have it at the tip of their fingers.

The participants noted that this did not "feel" like homework at all due to the fact that it is completely "driven" by them and led by their own interests and curiosity. Ronan states that, "It's not research" because he does not associate it with "work" or learning, because he does it on his own.

Computer devices and social interaction. "I post so that other people can share in that experience. Share the grand experiences of life, kind of thing" (Carissa).

All participants spoke at length on how they use their computer technology away from school to engage on a social level with their friends, family, and even complete strangers. Several comments were made about the ability to communicate with others who are not geographically close to them, in order to "stay in touch." Melinda states, "That's the biggest part of my day—being on an electronic device . . . whether it be responding to someone or . . . catching up with family or something like that." Elizabeth mentions that she is able to "see" her nieces and family through social medium forums, such as Facebook and Instagram. And Ronan

shared that he used technology to create calendars with his friends over the summer so that they could maximize their time together. He also stated that he consistently shared information with his friends by "tagging" them on posts that he liked and that he thinks that they will like: "I find something interesting . . . that my friends can relate to, I put their name in there so that they see it—or send a link to them or something like that. That is how I connect other people."

However, one specific participant was able to explain a more in-depth use than the others. Brendan spoke not only about sharing information with family and friends, but he spoke specifically to how he met others and learned about different people and different cultures through the use of technology:

> Starting my freshman year since online video games, you meet people online. . . . I have people on my Skype from all over the world. I have people in the Philippines, New Amsterdam, Britain, and I think that I have a couple of people somewhere in Asia. One, I think it's just cool to talk to other people because Harrisonville is pretty small and there are only so many people. When you start reaching out to people across the world, you learn different things.

He goes on to speak about how "connected" the world is today and that one can do so much with others from one place. He mentions that he can collaborate with others from around the world in his bedroom. He finishes his comment with, "If you don't have [technology] you are in the dark."

Health and well-being research and computer devices. In only one part of the study did females comment significantly on a topic where males did not is in the area of "health and well-being." The females made comments that ranged from using their technology to search for ways to make themselves healthier to commenting on how the process of using their digital devices provided health benefits on its own. Maggie expresses, "Well, to my mom I will usually say this is kind of my breathing, taking a breath for the day." She likens searching and "surfing" the Internet as her time to pursue her interests and take a mental break from school: "just doing

my own thing on the Internet, like doing my own research, something that's for me instead of doing it for school. . . . It's just for me." She stated that having this time was critical for her to be able to "check out" and relax during her otherwise demanding and stressful day.

The females spoke extensively on using their devices and the Internet to gain information in regard to health and wellness. Maggie discloses that she is "really interested in her body" and that she spends time on the Internet learning about it: "I use a lot of websites to kind of figure out like what my symptoms are physiologically doing to my body and what's going on." She specifically mentions spending a lot of time on the websites, WebMD and the Mayo Clinic website.

Carissa comments on her attempts to lose weight and how she uses the Internet to gain information that might help her:

> There's a whole bunch of stuff going around like detoxing and how to do it. There are these wraps that are going around too . . . oils that will help you . . . you wrap it around and helps you to lose weight, something like that. I'd just kind of look that up and be like, "do these oils actually help you to lose weight," or "what's the best recipe for detox water?" I usually look at the reviews and see the stars, like okay, that sounds good.

And Debra asserts that she is an athlete who is preparing to go to college on an athletic scholarship. She states that she is trying to take better care of her body and develop a physique that will help her to perform better at the college level. She comments that she uses technology to "look up workouts to build her shoulders, workouts to burn more body fat, find foods that are high in protein and low in fats."

College preparation with computer devices. The participants in the study spent a significant amount of time discussing what I have coded as preparing for college and their future careers. This ranges from skills that they have acquired from using their digital devices when away from school to actual communication and completion of tasks that were required of them

through their employer or by their college admissions counselor. Ryland references how much he has learned in regard to being able to research and locate information on a myriad of topics stating, "I think that further on down the line, like in college, if I need to research something, I can probably find a reliable source on the Internet through various search engines." And Melinda refers to the amount of time that she has spent inside of school and outside of school using various software programs on her laptop: "I'm like a pro at Excel now. I know that I'll need to use that in college."

Other participants are much more specific in how they use their devices for college preparation. The actions mentioned by the participants ranged from applying for scholarships, to selecting roommates, to college recruitment for athletics. All participants spoke to the advantages of having the ability to apply for scholarships online when they were away from school. The participates repeatedly affirmed that all of the school applications that they filled out were online, and when asked, they commented that having access to their devices away from school allowed them more time and opportunity to apply for a multitude of scholarship opportunities. Debra states, "All of my applications were online and almost all of my scholarships I had to access through the Internet." And Melinda notes that her guidance counselor posts scholarship opportunities online through the school's learning management system, as well as "updates about specific scholarships and information that I need to apply for them." Melinda also expresses that she is able to keep a digital portfolio of all 4 years of her high school career and use that to submit essays online.

Other participants spoke to making contact with their college admissions counselor once they had already been accepted into the school. Brendan says the following about making contact with his college counselor:

> His name is Roman—he's actually pretty funny. He works in the financial aid department at Trine. He informs me of the dates for summer orientation, which I think is June 12. He sends me letters and e-mails and tells me about all of the documents that I will need to bring. I can ask him anything.

And, Debra utilizes access to her laptop away from school to participate in the recruiting process for college athletics; specifically, track and field. She states that she uses her device to fill out questionnaires and have conversations with coaches where she may potentially go to school. Debra notes that it is much easier to communicate with them that way since everyone is so busy playing sports.

Still another use for the device when preparing for college is the newer concepts of meeting and choosing a roommate over the Internet. Carissa explains that she is able to go to her school's website and view profiles of potential roommates, as well as have conversations with them using Snapchat. She states that through this process she is able to make an informed decision on who to "room with" when she goes to college and has the ability to get to know that individual on a much closer basis before they actually meet face-to-face.

Workforce preparation with computer devices. Other participants spoke at length about having access to technology away from home and how that helps them to communicate and benefit them in work/career environments. Parker states, "I'll communicate with my work that day or if they need me to come in to fill in for somebody. Then, if I miss work, I can communicate with my co-workers to see what I missed." And Brendan comments on how much he uses his digital devices for marketing at work:

> They are big on social networking and using that as a free advertising tool . . . it's an obligation. Every time that I go to work, we have a peer-to-peer thing we have to share. You just log on to their website, enter your employee ID and your password and it takes you to shortcuts to whatever promos they have going on. Then, you choose one of the social media providers at the bottom and that actually makes it where you can select a different way to share each time that you work a shift.

One of the most compelling accounts of how access to digital technology benefited a participant in the study is Josephine's experience with her internship at the Indianapolis Zoo. The participant began to communicate with the zoo via e-mail when she was looking for an internship. There were no internships open at the time, but when the participant began to share over e-mail what her interests were, the Indianapolis Zoo created an internship for her: "my actual internship position was not a position before I did it. It was purely me talking to people within their administration and we created that position." Josephine stated that she used her school-issued laptop often to research the animals that she was going to be working with:

> I had to know more about what it's natural instincts were, so there were a lot of times before I would go train my bird that I would actually get on my Chromebook and I would do a little research about its natural habitat and it's natural instincts and how it would behave instinctually, in order for me to train it.

She goes on to add that without having access to the technology she more than likely would not have been able to reach out to the Indianapolis Zoo and share her ideas in the amount of depth that she did. Josephine plans to work for the zoo as her full-time job while she pursues a degree in Zoology, so that she can better design habitats for animals that live in zoo environments.

Summary of Findings

In summary, the findings of the study of how students involved in one-to-one laptop programs use their computers to learn when they leave the school setting were:

1. Access to digital devices away from the traditional school environment provided the participants with extended opportunities to learn. The participants stated that this access allowed them more time to work on assignments and the freedom to learn in a multitude of locations and styles.

2. LMSs used by the school allow the participants to access their school work from a central location. This improved the students' ability to be more organized and submit assignments in a timely manner, as well as receive quicker feedback from teachers and peers.
3. Having digital devices when away from school allowed the participants access to outside resources for academic help. The participants referenced websites such as Khan Academy to receive academic help extended beyond the traditional school hours.
4. The participants reported that along with having ubiquitous access to technology came ubiquitous access to information. Students reported searching for information on various topics throughout the afternoon, evening, and during the weekends. The topics ranged from required academic searches to a broad array of personal interests.
5. The participants reported that the computer technology made academic and personal work "easier" and more "efficient." Students voiced an increased speed in typing papers, taking notes, and creating projects.
6. The participants remarked that the digital devices allowed them to share various experiences with their peers and family members. The students reported that through the extended digital access they were able to communicate quickly with their classmates, as well as stay in touch with family members who do not live nearby.
7. The participants informed that through access to technology they are able to connect with others from different countries and cultures and share in their experiences. Students provided examples of seeking information and assistance from individuals

living in other countries, as well as creating personal relationships with these individuals.

8. In regard to "formal learning," the participants referenced using their devices for a myriad of tasks, ranging from reading textbooks, writing papers, creating projects, and tracking information online, to practicing for school-sponsored theatrical and musical performances.
9. Following the model of "nonformal learning," students reported the ability to choose specific topics for research projects and papers, allowing them the opportunity to incorporate their personal interests into their required classwork. The students said that having the ability to access information at all times of the day provided them with a broader range of research topics that appealed to them, resulting in increased amount of engagement and performance.
10. In reference to "informal learning," the participants noted that having access to digital technology when they are away from school allows them to learn using their own individual learning style. Some students prefer accessing their assignments and conducting research from the home setting or other settings because the school setting is "too loud," and other students utilize online information that provides visuals for reading texts.
11. Participants stated that having access to the technology when away from school allowed for a greater amount of repetition when practicing academics and performances, as their access significantly expands their learning window opportunities.

12. “Self-directed learning” was mentioned by students who used their digital devices to learn through personal interests that were not “assigned” to them by the school. The participants reported using the technology to learn more about topics ranging from astronomy to their personal health and well-being. Furthermore, the participants noted using their devices for gaming and connecting with others through various forms of social media.
13. Participants referenced using their devices to apply for college, write college essays, and search for and apply for college scholarships. The students reported having access to a large amount of scholarship opportunities through online searches that they conducted when away from the school setting.
14. Students also stated that they use their digital devices when they are away from school to communicate and conduct tasks for their employer. These tasks included creating schedules and marketing through the use of social media.
15. Participants reported using their devices to learn about current events. These students noted that they are able to stay abreast of local and global affairs through online news feeds that they access through social media and other news apps.
16. Participants claimed being informed consumers through the use of their technology. The participants stated that they are able to compare prices and find “deals” and sales online, thus providing them with “real-time” information that allows them to save money and resources.
17. Students reported using their access to technology to be socially active. Using their technology to gain information and access, participants voiced making specific purchases that provided monetary assistance to social issues that they support.

18. Students stated using their technology devices when they are away from school for entertainment purposes. The participants related these activities with relaxation and stress relief, as well as providing them with opportunities to stay connected to friends and loved ones.
19. Students commented that ubiquitous access to technology could sometimes be overwhelming and invasive, causing pressure and stress.

Chapter 5: Discussion

Introduction

The purpose of this study is to better understand how students involved in one-to-one computing initiatives form learning with their computing devices when they are away from the traditional school environment. Furthermore, the study seeks to better understand the roles of the traditional learning theories of behaviorism, cognitivism, and constructivism, as well as the newly developed learning theory of connectivism, in this digital learning environment. With a better understanding of how students choose to use computing devices on their own, and how they are instructed to use computing devices by their teachers, educators can more thoroughly understand the digital native students that they are teaching, and better reflect upon their instructional practices as digital immigrants in this technological age. Lastly, the study attempts to provide more depth of understanding in regard to the benefits and detriments of student access to digital devices when they are away from school in order to better inform district leadership, as well as state and federal policy makers, in regard to the choice of whether or not to implement and sustain one-to-one laptop initiatives.

The researcher utilizes Mocker and Spear's (1982) learning classification model to provide a starting point in the identification and coding of various kinds of learning reported in the study; while not all-encompassing, it provides a lens through which to inform the study, allowing the ability to better distinguish between the various types of learning constructed by the participants, including: formal learning; nonformal learning; informal learning; and self-directed learning. Secondly, learning reported by the participants is analyzed and categorized into the four learning theories mentioned above: behaviorism, cognitivism, constructivism, and connectivism. The utilization of the learning theories and models previously mentioned will help the researcher

to answer the question: *How do students involved in one-to-one laptop programs utilize computing devices to form learning in out-of-school environments?*

Study Summary

The study was conducted at a suburban high school next to a large Midwestern city. The participants in the study were in their senior year at Hadley High School and were 18 years of age or older. Participants were asked to take a brief survey and 12 students (6 male and 6 female) were selected in regard to their reported amounts of time spent using computing devices when they are away from the school environment, and for the range of purposes in which the devices were used. Once the 12 participants were selected, they were asked to participate in a single 30- to 45-minute standardized interview consisting of open-ended questions. The questions were designed to elicit insight into how the students used their laptop and other electronic devices when they were away from school to form learning.

The data from these interviews were then gathered, analyzed, and coded under the categories of: formal learning, nonformal learning, informal learning, self-directed learning, as well as other significant themes that emerged from the study. The data was then analyzed, coded, and categorized in regard to the learning theories of behaviorism, cognitivism, constructivism, and connectivism. Finally, the data was analyzed a third time to better understand various aspects of how students form learning with computing devices when they are away from the traditional school environment.

Discussion of Findings

This section of the chapter will provide an analysis and discussion of the key findings from the study that add to the existing field of knowledge in regard to one-to-one laptop programs and ubiquitous computing initiatives. While many trends emerged throughout the

research process, the key themes that add to our current understanding of computing initiatives are in the realms of: participant access to computing technology, student freedom in the learning process, and student identity development with computing devices and access to the Internet. While literature on these topics are expansive in regard to student achievement and educational impacts within the school setting, findings from this study will bring new insight into the broader discussion on technology integration and add to the narrative that is being constructed in regard to how students use computing devices when they are away from the school setting and have the freedom to shape and form their own learning experiences.

Access to computing devices. Much of the existing literature in the realm of computer access focuses on the benefits that technology integration have on student access to information and the impact of technology integration on educational outcomes (Bebell & Kay, 2010; Holcomb, 2009; Keengwe et al., 2009; Rockman & Walker, 2000). Furthermore, there is significant literature that visits the "digital divide" that exists among students and individuals whom have access to technology and those whom do not (Becker, 2006; Mossberger et al., 2008; Warf, 2012). And in both realms, an emphasis is placed on digital equity and promotes the concept that all students and citizens must have adequate access to advanced technologies in order to fully participate in the benefits that these technologies provide.

However, where findings from this study contribute most beneficially to existing literature is in the realm of home access, or extended access to digital devices. This study adds to the literature that promotes access to technology, but expands insight into how students utilize extended access to their computing devices through the one-to-one computer initiative when they are away from school to learn, while also offering further insight into the sometimes restrictive role that technology access can play in the learning experiences of the individual.

Specifically, findings from this study build upon the earlier work of Kent and Facer (2004) that sought to determine how student use of computing devices differ from school and home. In the same manner, the findings add to the literature of Lei and Zhao (2008) and Furlong and Davies (2012) whom all studied the home environment as a context for student learning with ubiquitous, "around the clock," access to computing devices. As technology changes rapidly, this study is able to provide a snapshot into the overall narrative of student home technology use at the time that the study was conducted, in spring 2015.

Data from the study shows that participants spent a great amount of time utilizing their computing devices, with 70% of them averaging 3–4 hours per day on their device when they are away from school. Students reported spending a great amount of time on social media sights such as: Facebook, Reddit, Snapchat, Instagram, and YouTube, and working on homework assignments. Participants predominantly chose to gather information and learn in areas that are rarely part of traditional school curriculum or e-learning curriculum, such as Josephine's and Brendan's Web searches to find information on products that they could purchase that would also benefit a social cause of their concern; and Ronan's quest to learn how to "curve" a soccer ball when striking it. With unlimited access to computing devices that were provided by the school and / or owned privately by the students, the participants were able to engage in the collection and dissemination of information of their choosing, on broad levels and on sometimes on a global scale.

Furthermore, this study is able to build upon the work of Jewitt and Parashar (2011) and Storz and Hoffman (2013) that sought to better understand the interests of students through their access and use of computing devices while at home. The goal of Jewitt and Parashar was to provide better understanding of student home use of computing devices so that teachers would be

better able to guide their learning at school. And Storz and Hoffman studied student home access in relation to their learning at home and at school, and how students used their computing devices as a primary tool for communication. In both areas, this study provided data in regard to how students of today utilize their devices to learn in regard to their personal interests, and how participants used their devices to communicate and participate in social activities.

In the following sections, the researcher will elaborate on how the students used this access to learn and grow in a self-directed manner. With unlimited access and few boundaries, the participants in the study were able to explore and discover a wide variety of topics of interest and learn about them in depths of their choosing. Furthermore, the researcher will add to the existing literature in regard to the limitations and intrusions that ubiquitous access to computing devices can provide to individuals involved in these programs.

E-learning and student freedom. A significant focus of the study was in regard to student freedom, and sometimes lack thereof, in the learning process. This autonomy in learning is described by Mocker and Spear (1982) as a continuum from "formal learning" in which the institution controls both the means and objectives of the learning activity and provides little to no autonomy for the learner, to "self-directed learning" or the ultimate state of learning autonomy where the learner controls the means and the objectives. The researcher found Mocker and Spear's learning continuum, developed in 1982, to hold relevant as a framework in regard to e-learning in our modern day. And data from this study adds to the work of Mocker and Spear and others whom have studied learner autonomy by viewing how students choose to utilize their computer devices to learn and how educators instruct the students to learn with their devices. Furthermore, in regard to student freedom, findings from this study should be added to existing

literature in that technology integration through ubiquitous computing programs does not automatically result in student freedom; rather, this shift must be intentional and sustained. While data gathered from the study did show a strong correlation between the integration of technology and student freedom in learning, it did so primarily when students were acting independently from the school. Data from the study suggests that technology integration at the school level, for example, through the use of LMSs, actually provide firm structure and extended control that often restricted student freedoms in the learning process when they left the traditional school environment. It is significant that these findings are not congruous with literature that promotes student freedom as a significant component of e-learning (Brown & Voltz, 2005; Kop & Hill, 2008; Upadhyay, 2006).

When the participants of the study were engaged in school-assigned learning activities while they were away from the traditional school building, they were given little control or autonomy in the learning process, despite the integration of computing devices. In many ways, data gathered from the participants showed the integration of technology and e-learning curriculum to only be an extension of traditional learning—providing students with no more freedom than they had without the integration of digital technology. Furthermore, participants from the study spoke of the intrusion that this technology had on their personal lives, as teachers expected them to use more time outside of school working on learning assignments that were controlled by the teacher. Just as Elizabeth referenced the increased "pressure" that she felt to work on school assignments at night and on the weekend, this access, along with teacher control, led to a significant decrease in student freedom to pursue their own learning in a self-directed manner.

However, when students left the school environment and possessed the freedom to learn independently with their computing devices—the data revealed the kind of individual growth and learning that previous research states is the fundamental change in the learning process that is currently taking place (Afifi & Alamri, 2014; Kop & Hill, 2008; Mossberger et al., 2008). The researcher found that the participants utilized the freedom that they possess at home, or away from school, to learn a myriad of topics of their choosing; topics that were infinitely complex and meaningful to the participants, thus fully engaging them. Brown and Voltz (2005) referenced the concept of "impact" and how individual learning affects not only the learner, but the broader impact upon the community in which they live. Through this lens, the researcher viewed data that provided a significant amount of sharing of information and learned materials from the participants to their peers and virtual community. The ability of the participants to discover their own interests and share them with others not only created learning and growth for the individual and his or her peers, but often focused on information that benefits the larger society through philanthropic endeavors.

Computing devices and identity development. A third key theme that emerged from the study was how the participants utilized their computing devices to develop identity. Throughout the study, participants primarily reported entering the realm of self-directed learning and identity development when they utilized the computing devices provided to them on their own time. This data further develops understanding in the realm of student use of computing devices outside of the school environment (Kent & Facer, 2004; Lei & Zhao, 2008) and the benefits of self-directed learning in informal environments (Furlong & Davies, 2012; Jewitt & Parashar, 2011; Sefton-Green, 2006).

With ubiquitous access to computing devices and the freedom to utilize these devices in an unlimited manner, participants in the study were able to discover information and interests on boundless levels. These individuals were able to experience and learn from other cultures around the world and then share these discoveries with their peers and families. Participants were able to move away from the more restrictive learning methods prescribed by their teachers and better discover their identity as an individual and as a learner. Luke provides an example of searching for and listening to jazz music, stating that one "search" leads to another and then another. He states that through this method, he is able to discover new music that he would never have otherwise heard. Elizabeth provides the narrative of her love for photography and her ability to use her computing device to grow in her skills of editing and to grow in her passion as an artist. With each individual discovery, the participants were able to better develop and understand who they are and whom they would like to become. This further builds upon the work of Brown and Voltz (2005) in what they call "impact." Brown and Voltz describe "impact" as the influence of the learning activity on the learner and the broader community in which the learner is involved. The participant's ability to grow and develop identity is another way of understanding the "impact" that the learning activities will benefit the students and those whom they share their learning with.

While following their own direction, participants in the study provided examples of looking up or "googling" information when they needed it, visiting various websites and blogs to access information or seek help with understanding and discovery. The participants also reported spending significant amounts of time utilizing their computing devices to be more informed consumers, not only for fiscal conservation, but for the ability to purchase goods from companies that supported various philanthropic causes in which they were compassionate toward. And, by

far the most prominent activity reported by the participants was utilizing their computing devices to research personal interests. From self-improvement to self-discovery, access to the computing devices allowed the participants opportunities to purse knowledge and information in a manner that appealed to them and change them.

Conclusion

As digital technology becomes more and more ubiquitous in our society and our schools, it is changing the way that our students learn and grow as individuals. The ability of the individual to utilize his or her access to computing devices to learn in a self-directed manner provides students boundless opportunities to seek information and form knowledge in areas of their own interests and to grow in understanding of the world and of themselves. Furthermore, access to these technologies provide the individuals with the ability to share their knowledge and understanding and interact with peers around the world in ways that have not before been possible.

As many schools provide students with access to computing devices through one-to-one initiatives, use of these devices in many different settings must be further understood so that the provision of this technology can maximize school-based student learning while providing individuals with the freedom to explore and discover learning on their own and in their own way when they are outside of the direct influence of the school.

Finally, educators must carefully reflect upon and question their motivations for technology integration into our educational environment. It is critical that we listen to the voices of our students and not make the assumption that more technology and ubiquitous access is necessarily better. As in many cases, there is likely to be a healthy balance found between

technology integration and more traditional methods of learning; the task of educators is to carefully explore these methods while focusing more on the student than on the technology.

Implications for future policy and practice. Policy makers and school officials should use caution in implementing ubiquitous computing initiatives. Not only should careful study and reflection be conducted in the realm of education effectiveness, but also sustainability. And while the adoption and implementation of technology integration initiatives would follow the societal trend of rapidly growing technology induction to our everyday lives and the workforce, the researcher encourages the reflection upon the negative effects of such initiatives and the impact that they might have on the learner.

In regard to education practitioners and theorists, the researcher encourages reflection and growth in the realm of utilizing technology and computing devices in the learning process. The researcher sees room for improvement in maximizing access to digital technology to provide learners with more autonomy, engagement, and ownership in the learning process. Digital immigrant educators must work to become more proficient with technology and gain the ability to meet the learners of today in the middle to better provide a learning environment that both maximized learning opportunities and the health and well-being of the student. In this regard, leaders in education must deliver more focused and in-depth professional development opportunities that are supplied on a frequent and continuous basis in order for staff to be sufficiently trained and up-to-date on best practices in the realm of e-learning and technology integration.

Implications for future research: Constructivist learning. In regard to learning theory, the researcher found the reported constructivist learning activities throughout the study to be a trend worth noting. Many participants in the study reported taking part in what Jonassen (1991)

would refer to as “advanced” or “expert” learning activities in that they required knowledge constructed by the students to solve complex problems. These activities included student-centered activities that required collaboration, problem-based learning, and discussion—all of which fall in the realm of constructivist learning. However, the researcher noted that within the constructivist learning paradigm, the activities that the students participated in at school involved predetermined truths by the teachers, leaving little room for learners to have control over the learning process and make their own decisions on learning goals. With proponents of digital technology and e-learning promoting the ability for individual student creativity within the realm of constructivist learning, primary learning methods of the student were related to objective truths and predetermined learning outcomes.

In comparison, when the students left the school environment—they were able to interact with their one-to-one devices in a completely different way. Through the participant’s interactions with their computing devices, the researcher was able to view their constructive learning in a different manner that, in his opinion, captures the more fundamental philosophy of constructivist learning in that the individual is not only an active learner in creating and constructing meaning from the world around them, but that they have much more freedom to create their own “truth” and much more autonomy in defining their own learning goals and outcomes. In this environment, students are truly creating their own meaning instead of acquiring it from an outside-guided entity. This becomes critically noteworthy due to the amount of learning activities, constructivist activities included, that are provided in school that have predetermined outcomes and learning objectives. If individuals learn and grow differently, then the ability to construct their own learning targets and outcomes might be a significantly missing component within curriculum and instruction in today’s schools.

In viewing the data from the study, the researcher finds further exploration of how computing devices are being utilized in educational environments to be worthwhile, as it reflects upon what educators are asking students to accomplish within the curriculum. To say it differently, one might ask educators if they are sufficiently allowing students to explore and create their own knowledge and truth, or are students predominantly provided with predetermined truths in which they are encouraged to interact with on a more cognitivist level. Regardless of the answer, the educator must reflect on what this says about how students are taught and how are students are encouraged to learn? Furthermore, there is much room to reflect upon and further study how the freedoms that are provided to students through computing devices impact them as individuals whom are creating learning away from school. Through one-to-one computing initiatives students have more access to information for more extended amounts of time; what they do with this information will greatly impact them as a learner both outside of the school and within the school.

Technology integration: How much is too much? With the rapidly advancing integration of technology into our society and school systems, it is important that we learn more about how this affects our students on a holistic level. Significant data from the study provided participant commentary that was not expected by the researcher, as many of the participants noted that technology integration from their school was invasive and even negatively impacted their mental and emotional health. The researcher feels that it is critical to listen to the voices of the students and learn more in regard to the negative effects of technology integration into our schools. With better understanding of this phenomenon educators and policy makers can better serve our students and not only prepare them as citizens, but better protect their well-being in the process.

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Appendix A: Participant Survey

Dissertation Student Survey - (main)

Q1 Participant's name:

Q2 Participant's gender:

5. Male (1)
6. Female (2)

Q3 Participant's Age:

7. 16 (1)
8. 17 (2)
9. 18 (3)
10. 19 (4)
11. Other (5) _____

Q4 What is your current grade level?

12. Freshman (1)
13. Sophomore (2)
14. Junior (3)
15. Senior (4)

Q5 Do you currently have a school-issued laptop device?

16. Yes (1)
17. No (2)

Q6 Please check the box of other digital devices that you have reliable access to when you are away from school.

- Cell phone (1)
- Tablet (example: iPad, Galaxy Tablet) (2)
- E-reader (example: Kindle, Nook) (3)
- Personal desktop computer (4)
- Personal laptop computer (5)
- Gaming console (example: Xbox, Play Station) (6)
- Other (7) _____

Q7 Do you currently have reliable high speed Internet access when you are away from school?

18. Yes, almost always (1)
19. No, almost never (2)
20. Sometimes (3)

Q8 Is your school-issued laptop device your primary device used to access the Internet and complete school work when you are away from school?

21. Yes (1)

22. No (2)

Q9 Outside of the school day (7:50 A.M.–2:34 P.M.), how many hours per week do you spend using a digital device?

23. 0–7 hours (averaging 1 hour or less per day) (1)

24. 7–14 hours (averaging 1–2 hours per day) (2)

25. 14–21 hours (averaging 2–3 hours per day) (3)

26. more than 21 hours (averaging more than 3 hours per day) (4)

Q10 Outside of the school day (7:50 A.M.–2:34 P.M.), what activities do you use digital devices for? (check all that apply)

- Homework / school work (1)
- Gaming (2)
- Shopping (3)
- Social Media (4)
- Communication (5)
- Researching topics of interest (6)
- Watching videos (7)
- Creating (projects, videos, music, art, writing, other) (9)
- Reading (10)
- Other (11) _____

Q11 From the activities that you selected in the previous question, list the average amount of time that you spend using each device on a weekly basis.

	Average number of hours spent per week using digital devices for the activity			
	0–7 (1)	7–14 (2)	14–21 (3)	more than 21 (4)
Homework / school work (1)	27.	28.	29.	30.
Gaming (2)	31.	32.	33.	34.
Shopping (3)	35.	36.	37.	38.
Social Media (4)	39.	40.	41.	42.
Communication (5)	43.	44.	45.	46.
Researching topic of interest (6)	47.	48.	49.	50.
Watching videos (7)	51.	52.	53.	54.
Surfing the Internet (8)	55.	56.	57.	58.
Creating Projects (9)	59.	60.	61.	62.
Reading (10)	63.	64.	65.	66.
Other (11)	67.	68.	69.	70.

Appendix B: Participant Interview Questions

Participant: David Lawson Date: April 13, 2015

Category: Male/High Use

1. Please tell me about yourself.
    - What grade are you in?
    - How long have you been in the school corporation?
    - Tell me a little about your experience in school.

2. How would others describe you as a student?
    - Parents?
    - Teachers?
    - Friends?

3. Describe your school's laptop program.
    - What does the program provide?
    - What are the benefits of this program?
    - What are the drawbacks?
    - How has this program helped you as a student?

4. In the survey, you selected the following "type" of devices as devices that you use:
    - Cell phone
    - Gaming console
    - Device 3

- Device 4

Please tell me more about your cell phone . . .

- What is the name of the device?
- Who has access to this device?
- Who primarily uses the device?
- How long have you had access to this device?
- Other . . .

Please tell me more about your gaming console . . .

- What is the name of the device?
- Who has access to this device?
- Who primarily uses the device?
- How long have you had access to this device?
- Other . . .

5. In the survey, you reported that you spend time away from school doing various activities with your digital device(s).

    A. You acknowledged that you spend time doing:

- **"homework / school work."** Specifically, what different kinds of **homework / school work** do you do?
- Gaming. Describe this process
- Social media: describe your use
- Communication: how do you communicate with others
- Researching topics of interest: describe this process

- Watching videos: describe this process

Follow up questions for each activity:

A. Homework / school work:

- Please describe this in as much detail as possible.

  a. What devices do you use for this purpose?

  b. How frequently do you use digital devices to _____?

  c. How much time do you spend on these activities?

  d. Are others involved in these experiences? If so, how?

  e. Why do you do these activities?

  f. Why do you use devices for these activities?

  g. How do you feel that the devices help you in this aspect?

B. In the survey, you reported that you spend time **gaming.**

- Please describe this in as much detail as possible.

  a. What devices do you use for this purpose?

  b. How frequently do you use digital devices to _____?

  c. How much time do you spend on these activities?

  d. Are others involved in these experiences? If so, how?

  e. Why do you do these activities?

  f. Why do you use devices for these activities?

  g. How do you feel that the devices help you in this aspect?

C. In the survey, you reported that you use your device for **social media.**

- Please describe this in as much detail as possible.

  a. What devices do you use for this purpose?

  b. How frequently do you use digital devices to _____?

  c. How much time do you spend on these activities?

  d. Are others involved in these experiences? If so, how?

  e. Why do you do these activities?

  f. Why do you use devices for these activities?

  g. How do you feel that the devices help you in this aspect?

D. Researching topics of interest:

  h. What devices do you use for this purpose?

  i. How frequently do you use digital devices to _____?

  j. How much time do you spend on these activities?

  k. Are others involved in these experiences? If so, how?

  l. Why do you do these activities?

  m. Why do you use devices for these activities?

E. Watching videos:

  F. What devices do you use for this purpose?

  G. How frequently do you use digital devices to _____?

  H. How much time do you spend on these activities?

I. Are others involved in these experiences? If so, how?

J. Why do you do these activities?

K. Why do you use devices for these activities?

Concluding remarks:

JACOB "JAKE" ALLEN, ED.D.

MISSION:

To help lead a school corporation in meeting their goals in serving their students and their community. To help create, grow and sustain high quality and systemic educational programming that prepares all students to thrive as citizens in our global society.

PROFESSIONAL ACHIEVEMENTS:

During my tenure serving the Mooresville School Community as principal of Paul Hadley Middle School we have progressed from an IDOE rating of "D" in 2009-2010 to consecutive IDOE "A" ratings in 2013-2014 and 2014-2015. During this time, our staff worked together to raise our ELA and Math scores ten percent while facing a fifteen percent increase in our free and reduced lunch population.

At PHMS, we have successfully implemented and developed a 1:1 laptop program. With the provision of laptop devices to all students we are able to create a more equitable learning environment that prepares students for success in the 21st century.

PHMS has been a district leader in implementing professional learning communities (PLCs) that allow for teacher communication, collaboration, and the ability to drive curriculum and instructional decisions that are standards-based and data-informed.

PHMS administration has implemented a system of formative and summative assessments that require close collaboration amongst teacher "teams" and utilizes common language and expectations to raise student learning and achievement.

The PHMS administration and staff have worked diligently to implement a new teacher evaluation system that is based upon accountability and trust. We believe that it is critical to view the evaluation rubric as a tool for reflection and improvement and use the evaluation process to grow together as educators.

EXPERIENCE:

Principal, Mooresville Consolidated School Corporation

2011- Present

I serve as the building leader in the areas of curriculum and instruction, building operations, facility maintenance, community outreach, and school safety. It is my daily responsibility to create and sustain a safe and positive climate for both students and staff that yield high levels of student learning.

IELA Member, Indiana University Center for P-16 Research and Collaboration

2016-Present

As a member of the Indiana Effective Leaders Academy (IELA) I team with representatives from the IU Kelley School of Business and education leaders throughout the state of Indiana to introduce the key principles and concepts of world class schooling and the urgency that exists in our current educational climate / introduce the necessary methodologies and techniques that will develop internal capacity and commitment for effective school leadership / and provide a framework for managing and driving for results.

Alumni Board of Directors Member, Indiana University School of Education

2015-Present

As a member of the board of directors I work with a team of highly motivated individuals who are passionate about making the Indiana University School of Education one of the best in the nation and the world. As a board, we seek to strengthen the school by providing direct input to the Dean and school leadership regarding programming, initiatives and priorities.

President, Indiana Curriculum and Instruction Association

2014-Present

The Indiana Curriculum and Instruction Association (ICIA) works closely with the Central Indiana Education Service Center (CIESC) to provide timely information and dialogue to stakeholders in regard to state standards, state testing, and education law and policy.

Member, Central Indiana Education Service Center (CIESC) Advisory Council

2015-Present

As a member of the advisory council, I work with education leaders from around the Indianapolis area to increase collaboration amongst member districts, promote the programs and services of CIESC, and to strengthen communication between CIESC and its members.

Dean of Students, Paul Hadley Middle School

2010-2011

As the dean, I served in various administrative roles as the district transitioned into a grade 7 – 12 setting. I designed and led the implementation of a new discipline system that drastically reduced student violence, improved student attendance, and created a safer learning environment with fewer disruptions. Furthermore, I developed a classroom framework that is designed to maximize instruction, engage students, and directly improve student learning.

English / Language Arts Teacher, Mooresville High School

2004-2010

I instructed junior and senior grade levels in state standard-focused American and British literature curriculum. Instruction was focused upon critical and analytical thought, particularly in regard to college preparatory reading comprehension and analytical writing skills.

EDUCATION:

INDIANA UNIVERSITY – BLOOMINGTON, DOCTORATE OF EDUCATION DEGREE (2017)

Major: Educational Leadership

Minor: Curriculum and Instruction

Dissertation Focus: Technology Integration and Student Learning

INDIANA UNIVERSITY – BLOOMINGTON, EDUCATION SPECIALIST DEGREE (2015)

Major: Educational Leadership

Minor: Curriculum and Instruction

INDIANA UNIVERSITY – BLOOMINGTON, MASTERS DEGREE IN LITERACY, CULTURE, AND LANGUAGE EDUCATION (2005)

SOUTHERN ILLINOIS UNIVERSITY-CARBONDALE, BACHELORS DEGREE IN ENGLISH LITERATURE (2001)

AWARDS AND RECOGNITIONS:

Indiana Middle School Principal of the Year, District 9 – IASP (2016)

Transformational Educator Award – Indiana University, School of Education (2014)

Dean F. Berkley Emerging Leader in Education Award – Indiana University, School of Education (2013)

HOPE Award / Teacher of the Year – Mooresville Schools (2009)